

INNOVATIVE TREATMENT TO COMBAT PHILOPOD CRUSTACEAN (*CYZICUS* SP.) IN FISH NURSERIES

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Abstract

The paper includes the results of experiments on the combat of philopod crustacean (Cyzicus sp.) which cause significant economic losses to the post-embryonic development of common carp and Asian cyprinids (silver carp, bighead carp and grass carp). To combat them, the effectiveness of the insecticide Proteus-OD 110 was tested, correlated with the application of technological procedures for the preparation of the ponds adapted for the growth of fish larvae. The experiments were conducted at S.C.D.P. Nucet, within the Mircea-Vodă experimental base. In order to ensure a profitable harvest, before the stocking of 3-5 days old fish larvae, the ponds were prepared according to the technological procedures. Disinfection and loosening of the bottom of the ponds was achieved by administering quicklime (CaO) in the amount of 200-1000 kg/ha and to increase the productivity of the ponds, manure (5000-10000 kg/ha) and rice bran were administered. In conclusion, in order to obtain optimal results in the period of post-embryonic development and growth in first year of cyprinids, we recommend that the technological instructions be adapted to each type of technology.

Key words: cyprinids fry, *Cyzicus* sp., Proteus OD 110 treatment.

INTRODUCTION

Modern fish farming means improving cultivation practices by adopting various measures such as proper distribution of the supplementary diet, proper application of fertilizers, maintenance of physicochemical factors, proper selection of crop species, disease prevention and other control measures (Sultana et al., 2020).

During larval development of fish, special care must be taken to provide live food at such a high density that it does not require effort on the part of the fish larva to search and capture. In nursery ponds, fish have many enemies and competitors, such as wild fish, frogs, birds and invertebrates from which they should be protected. Aquatic crustacean *Cyzicus* sp. is one of the most common aquatic pests in fish nursery ponds. The adult *Cyzicus* sp. it is about 1 cm long, resembling a shell, with two chitinous valves. They consumes detritus, bacteria and algae, constantly filtering water. The presence in large numbers of adults crustaceans in the nursery ponds produces a marked turbidity of the water

which causes losses of up to 100% among fish larvae. Pesticides (organophosphates, commercial insecticides such as Baytex, Dipterex, Dylox, Flibol, Fumadol, Masoten and Sumithion) are used to control aquatic insects and large zooplankton that grow in fish nursery ponds. Pesticides are a mixture of substances that are designed to control or slaughter or control the development of pests (undesirable organisms). These pests usually nematodes, microorganisms, insects and plant pathogens, that compete with human food and are responsible for transmitting diseases and destroying crops (Shefali et al., 2021).

In our country, to combat *Cyzicus* sp. Triclorfon was used (trade names: Clorofos, Onefon) (Oțel, 1989). Experiments over time have concluded that the application of this insecticide causes both complete destruction of zooplankton and serious damage to the liver of fish fry (Boz, 1998).

As an alternative to this we proceeded to test the effect of the insecticide Proteus OD 110 in the control of *Cyzicus* sp. This insecticide has multiple actions: systemic, contact and shock.

The formula is state of the art, oil dispersion (OD). Tiacloprid 100 g/l, Deltamethrin 10 g/l, gives the product an adhesion and a penetration of the systemic component superior to the other forms. Tiacloprid acts on the nervous system of insects, blocking the development of vital activities. Deltamethrin also acts on the nervous system of insects, having at the same time repellent and nutritional inhibitory effect on insects. Both components act by contact and ingestion on pests. The complex mechanism of action gives it a wide range of activities and allows the control of insecticide-resistant forms of other chemical groups.

MATERIALS AND METHODS

The Mircea-Vodă Experimental Base has a total area of 14.3 ha (of which 12 ha of water surface) and consists of 5 earthen ponds (with surfaces of 0.8-4.5 ha) equipped with specific exploitation facilities.

Within the Mircea-Vodă Experimental Base, (which belongs to SCDP Nucet), in the years 2020 and 2021, treatments were carried out to control the philopod crustacean *Cyzicus* sp. with the insecticide PROTEUS OD 110. According to the Safety Data Sheet of the product includes several ecological information, respectively, data on ecotoxic effects in fish, water fleas and algae.

Fish toxicity: LC50 Rainbow trout (*Oncorhynchus mykiss*) 0.386 mg/l, Exposure time: 96 hours

Daphnia toxicity: EC50 water fleas (*Daphnia magna*) 0.0427 mg/l Exposure time: 48 hours

Algae toxicity: IC 50 (*Pseudokirchneriella subcapitata*) 96.7 mg/l; Exposure time: 72 hours. This value refers to the active substance tiacloprid.

Algae toxicity: EC50 (*Pseudokirchneriella subcapitata*) > 9.1 mg/l

Exposure time: 96 hours This value refers to the active substance deltamethrin.

Several tests were performed to determine the optimal doses, lethal doses (LD) of Proteus OD 110 insecticide. For these tests aquariums (50 l) and growth ponds (0.8-4.5 ha) were used. In addition to dose setting, the aim was to determine how to use the product, as well as the effect of the product on the juveniles and fish fry.

Preparation of nursery ponds

The biotechnological works for the preparation of the nursery ponds destined for the larval development of cyprinids aim to ensure optimal environmental conditions by intensifying the natural productivity; ichthyopathological prevention; protection against predators; the possibility of fishing the fish fry completely, quickly and with diminished stress.

Regarding the growth of carp larvae in polyculture with Asian cyprinids, this is done in two distinct stages:

- stage I- postlarval growth up to the juvenile stage (usually done in nursery ponds);
- stage II - rearing the juvenile to the fry stage, usually in the same nursery ponds (Costache et al., 2006).

In the case of the Mircea-Vodă Experimental Base, these stages of growth for cyprinids in summer I are carried out in the same ponds. The synthetic scheme for the preparation and rearing of cyprinids in the first stage included the following technological sequences:

- ponds drying;
- administration of lime with the role of disinfection and loosening of the bottom of the ponds was achieved by administering quicklime (CaO) in the amount of 200-1000 kg/ha and to increase the productivity of the ponds, manure (5000-10000 kg/ha) and rice bran were administered. Due to their availability and low cost, rice bran is used as a fertilizer in ponds to increase production. Dominisac (1974) shows that the use of rice bran acts initially as a pesticide and later as a fertilizer (Rice bran: 400-600 g/m² at 5 cm water depth). This is a method that is accepted due to its double effect: control of predators and at the same time, fertilizer of the ponds.
- plowing and disking the bottom of the basins and where the situation requires must apply herbicides on the bottoms of dried ponds and over the banks.
- flooding the ponds with technological water.
- 6-10 days before the fish larvae stocking, water samples are collected for chemical analysis to determine the content of biogenic substances for the administration of fertilizers. The composition of zooplankton is determined quantitatively and qualitatively. The availability of phytoplankton has a synergistic effect in

raising the growth performance and the survival rate of farmed fish in semi-intensive systems.

- if it is necessary, 9-10 days before the fish larvae stocking, the water is treated for the destruction of zooplankton (especially the crustacean *Cyzicus* sp. adult forms) with the insecticide Proteus OD 110.

- the stocking of 3-5 old fish larvae in nursery ponds should be done in sunny and warm weather, without wind (which can generate waves) and in more protected, shallow shore areas, which provide optimal conditions for their growth and development.

- when the amount of natural food (phyto and zooplankton) in the nursery ponds where treatments have been carried out to combat *Cyzicus* sp. has been reduced, the feed ration will be supplemented by the administration of fodder up to 15 kg/ha/day.

Among the most important factors that influence the growth and development in the early stages of fish life and cause significant mortality among the fish population, which negatively affect growth and cause poor health are largely common to both stages of growth:

- inadequate physico-chemical quality of the technological water and the culture ponds;

- availability of specific natural food in nursery ponds;

- presence of aquatic pests (mammals, water birds, predator fish, insects and predatory aquatic invertebrates found naturally in all freshwater bodies;

- cannibalism that occurs among carp juveniles, especially when the larvae and fry have differ in sizes;

- manifestation of extreme meteorological phenomena for long periods (strong winds or sudden temperature variation) especially in shallow water ponds;

- excessive growth of aquatic macro-vegetation and/or phytoplankton which may cause dissolved oxygen depletion especially during the nights and/or after several days of continuous rain and cloudy, causing asphyxiation of fish;

- oxygen supersaturation on hot sunny days can cause gas embolism;

- inherent toxicity due to certain algal blooms;

- diseases caused by ecto- and endoparasites;

- bacterial, fungal and viral infections that cause disease and mortality;

- anomalies and deficiencies of health due to nutritional deficiencies.

The data on the actual preparation of the ponds for growing in the first summer, in order to obtain good production results are included in Table 1.

Water quality was closely monitored during the growing season in the first summer. The main parameters of water quality were determined: temperature (°C), pH (digital pH-meter), transparency (Secchi disk), dissolved oxygen (DO, HQ40d HACH company), abundance and structure of phytoplankton and zooplankton.

In the first stage (up to the age of 30 days) for carp alevins raised in polyculture with Asian cyprinids, was administered artificial feed with a PB content of 32-40%. The ingredients included in the feed are: prestarter type flours, fish meal, powdered milk, brewers yeast, vitamin premixes, rice bran, cereal flours etc.

In the second stage of growth (30-130 days) the fodder has a PB content of 22-25%. The recipe includes traditional ingredients (wheat, corn, sunflower meal, rice bran, soy, etc.).

The main biotechnological works carried out in the years 2020 and 2021 at the Mircea Vodă Experimental Base carried out for polyculture nursery ponds of carp and Asian cyprinids are presented in Table 1.

RESULTS AND DISCUSSIONS

To control *Cyzicus* sp. with the insecticide Proteus OD 110 the therapeutic dose of 0.042 mg / l was established. Exposure time was 96 hours. For the treatment of *Cyzicus* sp. adults from fish ponds the recommended dose is 20 ml Proteus OD 110 insecticide per 10000 m³.

Table 1. The main biotechnological works carried out in the years 2020 and 2021 at the Mircea Vodă Experimental Base

Year 2020					Year 2021				
EC1	EC2	EC3	EC4	EC5	EC1	EC2	EC3	EC4	EC5
Manure administration 5-10 t/ha					26.04 - Manure administration 5-10 t/ha				
01.05.2020 - administration of lime chloride (kg)					08.05.2020 - administration of lime chloride (kg)				
450	600	460	1000	200	460	600	460	1000	200
02.05.2020 - plowing and disking					11.05.2020 - plowing and disking				
yes	yes	-	yes	-	yes	yes	-	yes	-
08.05.2020 - herbicide ponds and banks					14.05.2021 - herbicide ponds and banks				
12.05.2020 - start water supply to the ponds					15.05.2021 - start water supply to the ponds				
18.05.2020 appearance <i>Cyzicus</i> sp.					22.05.2021 appearance <i>Cyzicus</i> sp.				
yes	yes	-	yes	-	yes	yes	-	yes	-
Combat treatment <i>Cyzicus</i> sp. with PROTEUS OD 110 20.05.2020					Combat treatment <i>Cyzicus</i> sp. with PROTEUS OD 110 26.05.2021 EC1 and EC4 28.05.2021 EC2				
29.05.2020 Stocking with koi carp larvae (thousands of larvae)					03.06.2021 Stocking with koi carp larvae (thousands of larvae)				
-	-	100	100	-	100	100	-	100	-
02.06.2020 Nursery ponds filling rates (%)					07.06.2021 Nursery ponds filling rates (%)				
100	100	100	90	75	100	100	100	90	75
14.06.2020 Stocking with <i>C. carpio</i> larvae (thousands of larvae)					22.06.2021 Stocking with <i>C. carpio</i> larvae (thousands of larvae)				
300	300	200	450	50	300	300	100	400	75
15.06.2020 Stocking with <i>H. molitrix</i> larvae (thousands of larvae)					28.06.2021 Stocking with <i>H. molitrix</i> larvae (thousands of larvae)				
100	300	100	100	50	300	300	150	400	75
Stocking with <i>Ct. idella</i> larvae (thousands of larvae)					Stocking with <i>Ct. idella</i> larvae (thousands of larvae)				
200	250	100	250	50	300	300	300	150	75
From 16.06.2020, started the feeding of the fish					Stocking with <i>A. nobilis</i> larvae (thousands of larvae)				
22.06.2020 Stocking with <i>A. nobilis</i> larvae (thousands of larvae)					300				
100	200	300	600	50	300	300	300	600	75
					From 23.06.2021, started the feeding of the fish				

Distribution of the insecticide is done after dissolving the calculated amounts in cold water. The solution obtained is dispersed by means of a vermored type spray pump from the boat, at a distance of approximately 2 m from the shores of the ponds. It was not necessary to distribute the solution over the entire surface of the nursery ponds.

Following the application of the Proteus OD 110 treatment in the nursery ponds from Mircea Vodă Experimental Base, the destruction of the philopod crustacean *Cyzicus* sp. resulted. In a very short time, the water was cleared and a significant presence of small zooplankton (rotifers) and green algae was observed, which is the natural food in the first stage of growth for carp larvae and phytoplankton-eating fish. The natural food formed by zooplankton was the result of fertilization with manure.

After 9-10 days from the application of the treatment, the nursery ponds were stocked with fish larvae (3-5 days old): common carp (*C. carpio*) in polyculture with Asian cyprinids (*Ct. idella*, *H. molitrix*, *H. nobilis*) (Table 1).

In nursery ponds after applying the treatment to control *Cyzicus* sp. no clinical manifestations and mortality were recorded for fish alevins. Both in 2020 and in 2021, analyzes of the main physico-chemical parameters of the water and hydrobiological analyzes were performed throughout the growing period (Table 2).

According to the results obtained, the fertilizer doses were established and applied.

The main parameters of water quality for optimal survival and growth are: temperature between 18-28°C, dissolved oxygen 4.0-8.0 mg/l and pH 6.8-8.0 (Table 2).

Table 2. The main parameters of water quality

No.	Physico-chemical parameters	U.M.	Year 2020	Year 2021
1.	Temperature	°C	18-28	19-28
2.	Dissolved oxygen	mg/l	6.2 ± 0.81	6.8 ± 0.93
3.	pH	upH	7.2 ± 0.3	7.21 ± 0.2
4.	Organic substance	mg/l	24.00 ± 1.82	24.2 ± 1.74
5.	Total alkalinity	mg/l	168 ± 36	165 ± 38
6.	NH ₄ ⁺ - N (mg/l)	mg/l	0.030 ± 0.006	0.032 ± 0.009
7.	NO ₃ ⁻ - N (mg/l)	mg/l	0.280 ± 0.072	0.266 ± 0.039
8.	PO ₄ ⁻ - P (mg/l)	mg/l	0.063 ± 0.008	0.064 ± 0.007

It is recommended to maintain water quality parameters, including pH at a level that ensures optimal growth and good survival of the biological material.

The main technological bioindicators of performance obtained within the Mircea-Vodă Experimental Base in 2020 and 2021 for common carp (*C. carpio*) in polyculture with Asian cyprinids (*Ct. idella*, *H. molitrix*, *H. nobilis*) are presented in Table 3.

Table 3. The main technological bioindicators of performance obtained within the Mircea-Vodă Experimental Base in 2020 and 2021

Technological bioindicators of performance	Mircea-Vodă Experimental Base (12 ha)									
	Carp (<i>C. carpio</i>)		Grass carp (<i>Ct. idella</i>)		Silver carp (<i>H. molitrix</i>)		Bighead carp (<i>H. nobilis</i>)		Total / Average	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Years	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Number of fish larvae stocked (mil.)	1.5	1.475	0.85	1.175	0.65	1.525	1.25	1.575	4.4	5.45
Percentage by species at stocking (%)	35,3	25.9	20.0	21.6	15.3	26.8	29.4	27.6	100	100
Number of fish fry harvested (thousands)	301	203	214	198	171	276	318	268	1014	923
Average harvest weight (g/ex)	38	42	31	36	29	32	30	34	32	36
Total biomass at harvest (kg)	11435	8539	6480	6513	4995	8829	9529	9118	32400	33000
Survival rate (%)	20	14	25	16	26	18	25	17	23	17

CONCLUSIONS

In conclusion, in order to obtain optimal results in the period of post-embryonic development and growth in first year of cyprinids, we recommend that the technological instructions be adapted to each type of technology.

After the treatment against the phylopoes pest (*Cyzicus* sp.) in the cyprinid nursery ponds, a short period of time passed until the appearance of small forms of zooplankton, so the stocking of the fish larvae was made after 9-10 days.

The good growth rate and optimal health were obtained due to the abundance of specific natural food not being affected by the applied treatments.

The survival rate of the fish material (from 3-5 days larvae until autumn at age 0+) in 2020 was 23%, respectively 17% for 2021.

The productions obtained within the Mircea Vodă nursery materialized as follows: in 2020 a production of 2700 kg/ha was obtained and for 2021 the production was 2750 kg/ha.

When additional feeding and fertilizing are done simultaneously, high survival and rapid growth of larvae stocked in the nursery are achieved.

Compliance to the recommendations regarding the application of treatments to control diseases and pests as well as other measures within the fish farm ensures the achievement of good production results.

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