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THE EFFECT OF LEVAMISOLE ON SURVIVAL OF SIBERIAN STURGEON (*Acipenser baeri* Brandt) FRY IN WATER RECIRCULATION SYSTEM

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A B S T R A C T. An experiment was carried out on the effect of levamisole on survival of Siberian sturgeon (*Acipenser baeri* Brandt) fry. The experiment was done in two series: in first series fish were treated with levamisole 4 days after hatch, and in second series - 11 days. Levamisole was applied in immersion solution, in concentration 5 mg/dm^3. Both series of fish were reared until day 27 post hatch. Survival of fish in first series was 77% for fry treated with crystalline levamisole, 69% for fry treated with levamisole in 10% solution, and 47.5% in the control.In second series survival of treated fish was equal to 91%, comparing to 85% in the control.

Key words: STURGEON, INTENSE FRY REARING, IMMUNOSTIMULATION, LEVAMISOLE

INTRODUCTION

In water recirculation systems equipped with purification devices fish are well protected from infection with pathogens, which is particularly important under conditions of intense rearing.

However, stocking material produced under such conditions may show higher susceptibility to infections when transferred to natural waters. Limited immune response may be caused by lack of contact with antigens.

Fish are first organisms, from the evolutionary point of view, equipped with fully developed immunological system, and their immune response includes non-specific and specific mechanisms.

Possibility of non-specific immunostimulation in some Teleost fish was already experimentally proved (Anderson, Siwicki 1989, Siwicki et al. 1989, Siwicki 1990, Siwicki, Cossarini-Dunier 1990, Siwicki et al. 1990, Siwicki et al. 1994). Among synthetic immunostimulators, levamisole is most widely applied. Additionally, this stimulator reduces immunosupressive effect of intoxication (Siwicki, Studnicka 1992) and pro-

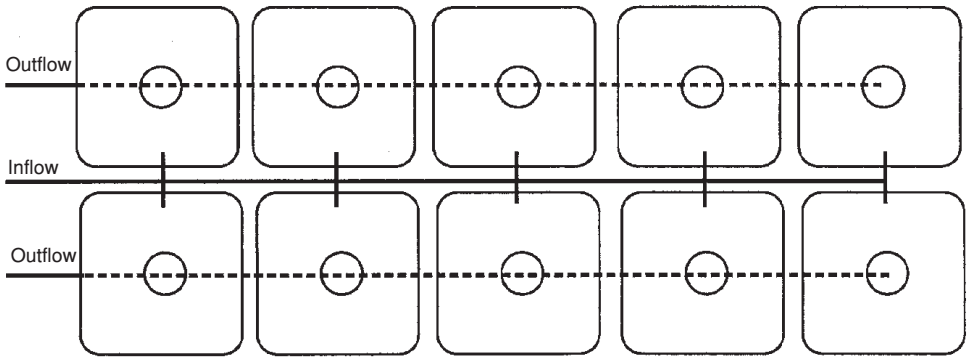

Fig. 1. Rearing system

motes growth and development of common carp juveniles (Siwicki, Korwin-Kossakowski 1988).

A study was undertaken to assess the effect of levamisole on early ontogenetic stages of Siberian sturgeon (Acipenser baeri Brandt) and to determine optimum time of levamisole application during intense pre-rearing of sturgeon fry.

MATERIAL AND METHODS

Sturgeon fry at the stage of yolk-sac resorption was used in the experiment. Experimental pre-rearing and mortality observations were carried out in a flow-through tanks of 10 dm^3 (Fig. 1.) connected with the water recirculation system of semi-commercial scale rearing vats with sturgeon fry.

Two series of experiment were done. In first series levamisole in two different forms was used: 10% solution produced by Gorzow Pharmaceutical Factory (group 1), and pure crystalline levamisole made by Rhone Merieux, Lyon (group 2). In second series only crystalline levamisole was used. In both series stimulator was applied in immersion bath, in concentration of 5 mg/dm^3, for 20 minutes. In first series fish were treated on day 5 after hatch. Two days later (day 7 of rearing) 100 fish were taken from each treatment and from the control, and transferred to 6 tanks in which further rearing took place. In second series immunostimulation of fry and stocking were done on days 12 and 14, respectively. As in first series, two tanks were stocked with treated and two with untreated fish (control).

Mortality was estimated twice a day: between 7 and 8 a.m. and between 7 and 8 p.m., while removing faeces and non-consumed feed from the tanks. Mortality was calculated in percent as average of both replicates of each experimental group. Survival was calculated according to the formula:

$$S_{\%} = \frac{S_i - D_n}{S_i} \cdot 100 \qquad (1)$$

where: $S_{\%}$ - survival of fry to day „n", in percent

S_i - initial stock number (ind.)

D_n - number of deaths on day „n" (ind.)

During the experiment fish were fed with pre-starter STAN-AC. Feed was applied initially in small quantities, and from the beginning of active feeding (day 12 after hatch) at the rate of 50% of stock mass per day, hourly, for 24 h. Daily feeding rate was gradually reduced down to 20% until the end of pre-rearing (day 27).

Until the beginning of active feeding rearing temperature was maintained at 17°C, then it was gradually rised up to 21°C (by about 2-3°C per day). DO measured at the outflow exceeded 6 mg/dm^3, ammonia and nitrite concentrations were well below treshold for Salmonid fish fry (Kolman 1992).

RESULTS

In first series of the experiment maximum mortality was observed on day 8 of rearing (Fig. 2.). Highest loss took place in the control (23%), comparing to both stimulated groups (1 and 2) in which mortality was equal to 7%. Another increase of mortality was observed about 16-17 day of rearing. In this case too, higher loss occured in the control comparing to the immunostimulated groups: 6.45% and 4.71%, respectively.

Survival of fry during the experimental pre-rearing in first series of the study (Fig. 3.) was highest in group 2: 77%, slightly lower in group 1: 69%, and lowest in the control: only 45.5%.

In second series of the experiment highest loss took place between days 17 and 22 and was more pronounced in the control (Fig. 4.). Total survival of fry at the end of rearing was higher in stimulated group (91%) comparing to the control (85%) (Fig. 5.).

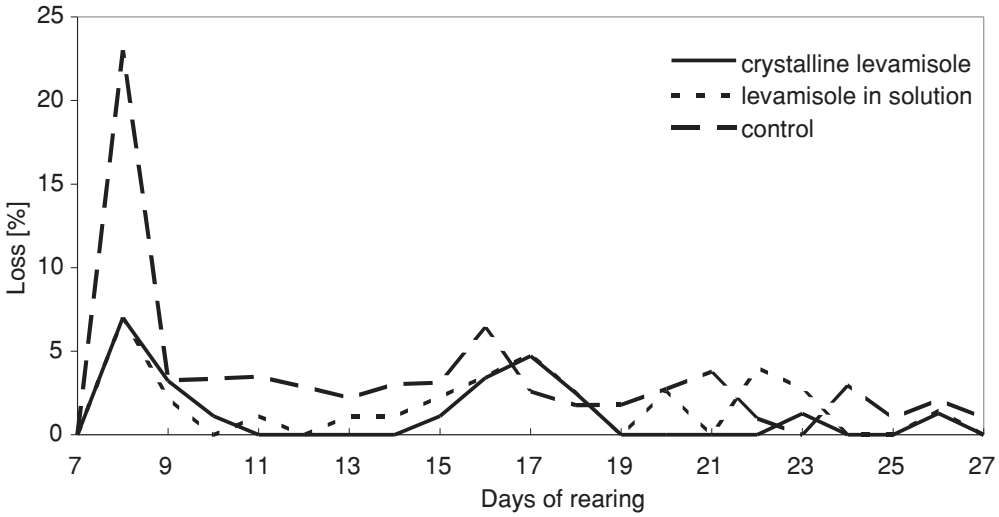

Fig. 2. Comparison of fish loss in stimulated group and control (first series)

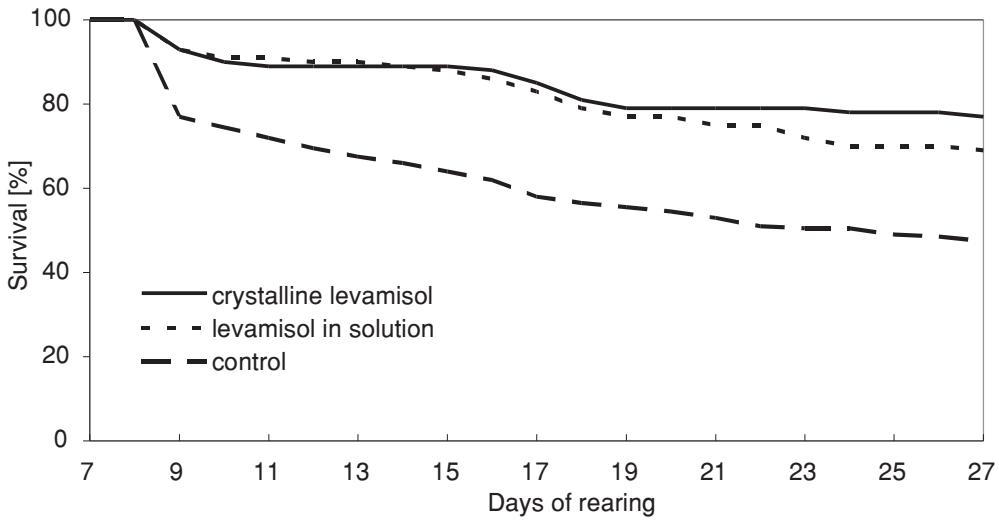

Fig. 3. Comparison of fish survival in stimulated groups and control (first series)

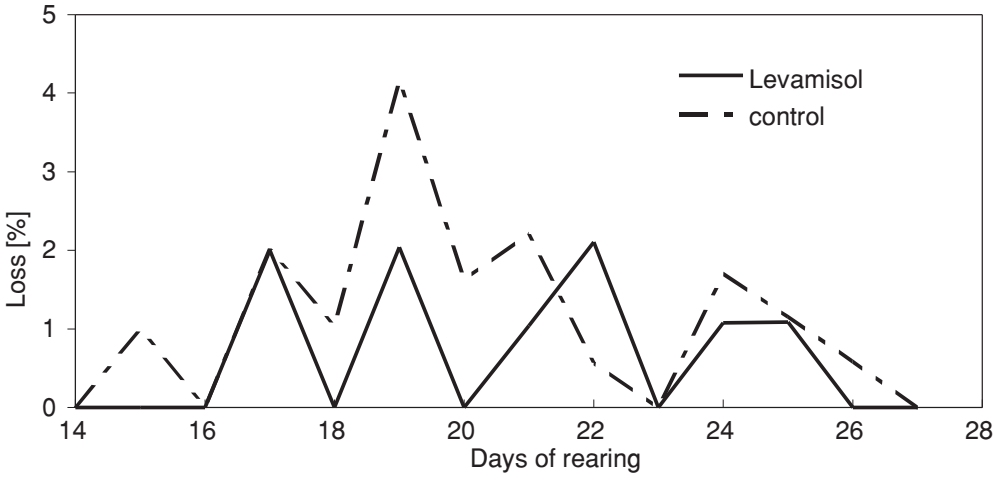

Fig. 4. Comparison of fish loss in stimulated groups and control (second series)

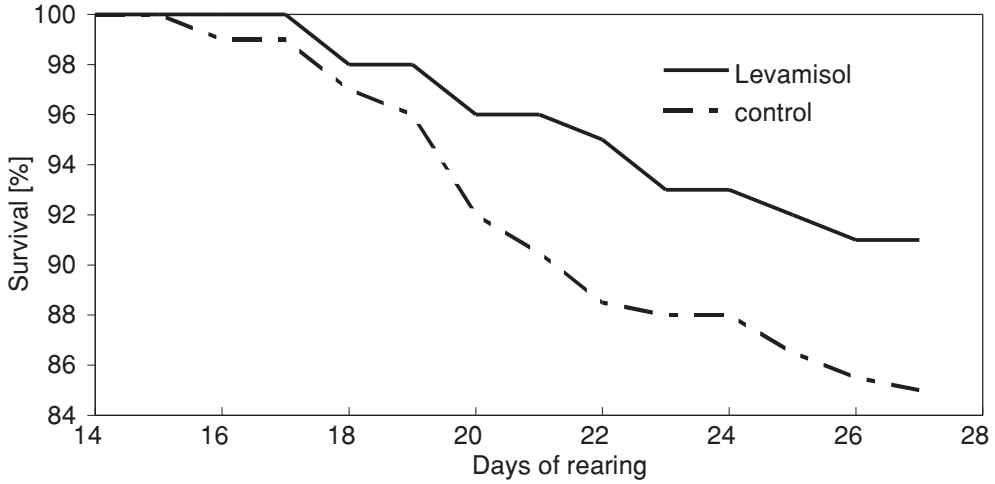

Fig. 5. Comparison of fish survival in stimulated group and control (second series)

DISCUSSION

Early stages of sturgeon pre-reared under controlled conditions exhibit 2 or 3 peaks of mortality, which can be explained with theory of critical periods in fish development (Vladimirov 1975). First peak, usually highest, occurs before fish undertake exogenous feeding (between day 6 and 13). Next peak takes place already after start

of active feeding (day 17-22) (Vladimirov, Semenov 1959, Chikhachov et al. 1981, Kolman 1993, Kolman, Szczepkowski 1995).

First peak of mortality is closely related to condition and health of spawners, quality of sexual products, fertilization technique and the technique of incubation of eggs (Vladimirov 1975). Level and time of occurence of deaths depend also on the species, as well as on the environment conditions during pre-rearing, mainly on water temperature. Mortality occuring in fry after beginning of exogenous feeding is related primarily to the quality of feed and technique of feeding, as well as to water temperature (Chikhachov et al. 1981, Kolman, Szczepkowski 1995).

The results obtained in the experiment reveal that levamisole treatment during yolk-sac resorption (first series) and after beginning of active food uptake (second series) increases survival of sturgeon fry. The effect of levamisole was most significant during the period preceeding exogenous feeding. Survival of immunostimulated fish was by 70% higher, comparing to the control. Although survival of the fry may vary being dependent on the environmental factors, it's important that mortality can be reduced. Loss of fry is often caused by various factors that cannot be completely eliminated, such as deterioration of water quality in natural environment of sturgeon spawners, and genetic factors of natural and reared populations of spawners (Arefjev 1992, Andronov 1983, Burtsev et al. 1987).

Thus, the results of the study on the effect of levamisole on survival of sturgeon (Acipenser baeri Brandt) fry indicate that immunostimulation at the beginning of yolk-sac resorption was most effective. Application of levamisole to the yolk-sac fry increased survival by over 20%, while treatment of actively feeding fish only by 6%. Moreover, early application of levamisole reduces fish loss caused by the factors that cannot be eliminated.

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REFERENCES

Anderson D.P., Siwicki A.K. 1989 - Immunostimulation by levamisole in rainbow trout (*Salmo girdneri*) in vivo. in: Viruses of lover vertebrates. Ahne W., Kurstak E. (Eds), Springer - Verlag Pub. Berlin, New York, 469-478.

Andronov A.E 1983 - Izuchenije vnutrividovoj differentsjatsji sevrugi po sostojaniju polovykh zhelez proizvoditelej v nizovijakh Volgi. in: Biologicheskije osnovy osetrovodstwa. Izd. "Nauka" Moskva: 61-72.

Arefjev V.A. 1992 - Citologitcheskij aspekt raznokatchesvennosti proizwoditelej vozvratnogo gibrida bestera i belugi.In: Biologicheskije osnovy industrialnogo osetrovodsrva. Sbor. Nautch. Trud., Moskva VNIRO: 212

Burtsev I.A., Nikolaev A.I., Arifjev V.A., Serebrannikova E.V., Slizchenko A.G. 1987 - Osobennosti vozvratnykh form bestera i napravlenija selekcji s ikh ispolzovaniem. In: Genetocheskije issledovanija morskikh gidrobiontov. Sbor. Nautch. Trud., Moskva VNIRO: 143-156.

Chikhachov A.S, Putina E.P., Savchenko S.V. 1981 - Prichiny otkhoda molodi gibridov osetrovykh pri vyrashchivanii v basejnakh. Rybn. Khoz. nr.7: 36-38.

Kolman R. 1992 - Efektywność biologicznego filtru półkowego zastosowanego do uzdatniania wody w systemie recyrkulacyjnym przy wychowie pstrąga. Arch. Ryb. Pol. supl.1: 37 s.

Kolman R. 1993 - Wyniki intensywnego chowu wylęgu i narybku bestera w warunkach zamkniętego obiegu wody. Kom. Ryb. 5. Wyd. IRS: 10-13.

Kolman R., Szczepkowski M. 1995 - Comparison of the growth rate and survival of three hybrids of the surgeons (*Huso huso* L.) and (*Acipenser rutenus* L.) - International Conf. New fish species in aquaculture. Szczecin 23-24 oct.1995, Wyd. A.R. w Szczecinie: 19-25.

Siwicki A.K. 1990 - Stymulowanie odporności komórkowej i humoralnej u karpia (*Cyprinus carpio* L.) preparatem lewamizol. Seria Wydawnicza - Rozprawy Naukowe 128. Wyd. A.R.-Lublin: 73 s.

Siwicki A.K., Anderson D.P., Studnicka M. 1994.: The immune system of fish. Arch.Ryb.Pol. vol.2, 67-79.

Siwicki A.K., Anderson D.P., Dixon O.W. 1989.: Comparisons on nonspecific and specific immunomodulation by oxolinic acid, oxytetracycline and levamisole in salmonids. Vet. Immunol. Immunopathol. 23, 195-200.

Siwicki A.K., Anderson D.P. Dixon O.W. 1990 - In vitro immunostimultion of rainbow trout (*Oncorhynchus mykssis*) spleen cells with levamisole. Development and Comparative Immunology, 14, 231-237.

Siwicki A.K., Cossarini-Dunier M. 1990 - Effect of levamisole on the lymphocyte and macrophage activity of carp (*Cyprinus carpio*), Annales de Recherches Veterinaires,21,95-100.

Siwicki A.K., Korwin-Kossakowski M. 1988 - The influence of levamisole on the growth of carp (*Cyprinus carpio*) larvae. J. Appl. Ithtiol. 4, 178-181.

Vladimirov V.N., Semenov K.N. 1959 - Kriticheskij pieriod w razvitii lichinok ryb. Dokl.An SSSR, t.126, nr 3.

Vladimirov V.N. 1975 - Kriticheskije periody razvitija u ryb. Vopr. Ichtiol. vyp.6 t.15: 955-975.

STRESZCZENIE

WPŁYW LEWAMIZOLU NA PRZEŻYWALNOŚĆ WYLĘGU JESIOTRA SYBERYJSKIEGO (*Acipenser baeri* Brandt).

Przeprowadzono badania celem których było określenie wpływu lewamizolu na przeżywalność wylęgu jesiotra syberyjskiego (*Acipenser baeri* Brandt). Badania prowadzono w dwóch seriach. W pierwszej serii stymulację lewamizolem przeprowadzono po czterech dniach od wylęgu natomiast w drugiej po 11 dniach. Lewamizol podawano w imersji w roztworze o koncentracji 5 mg/dcm3. W pierwszej serii stosowano lewamizol w dwóch postaciach: czystej, krystalicznej i 10% roztworu produkowanego przez Gorzowski Zakład Farmaceutyczny. W każdej serii oprócz grup stumulowanych (w dwóch powtórzeniach) równolegle podchowywano po dwie grupy kontrolne. Wylęg był karmiony paszą sztuczną.

Podchów w obu seriach prowadzono do 27 dnia. Nasilone straty w pierwszej serii wystąpiły dwukrotnie: 8 i 16-17 dnia, a w druigiej 17-22 dnia chowu. W każdym przypadku najwyższe straty odnotowywano w grupach kontrolnych. Przeżywalność liczona po zakończeniu eksperymentalnego podchowu w pierwszej serii badań wyniosła w grupach stumulowanych lewamizolem 77% (lewamizol krystaliczny) i 69% (lewamizol w 10% roztworze), a w grupie kontrolnej - 47.5%. W drugiej serii badań przeżywalność wylęgu poddanego działaniu lewamizolu wyniosła 91%, a grupy kontrolnej - 85%.

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