

HEMATOLOGICAL RESEARCHES IN SOME FARMING CYPRINIDS IN CONTROL CONDITIONS OF THE PARASITICAL STRESS

CERCETĂRI HEMATOLOGICE LA UNELE CIPRINIDE DE CULTURĂ ÎN CONDIȚIILE CONTROLULUI STRESULUI PARAZITAR

MISĂILĂ ELENA RADA *, MISĂILĂ C. **, VASILE GABRIELA **,
CIORNEA ELENA **

* S.C.D.A.E.A. Iași, România

** Faculty of Biology, "Alexandru Ioan Cuza" University, Iassy, România

*The present study analyses the hematological responses of some one year-old cultured cyprinids (C_{1+}) - common carp (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) - grown in polyculture for 220 days, in the conditions of an antiparasitical treatment, applied both as prophylactic one and along to the growth period (Trichlorfon preventive in doses of 0.1 mg/l in two steps and Calcium hypochlorite 2kg/ha two times/week). The usual hematological indices values, determinate in the end of the experiments evidenced the fact that, in two variant taken under study both the levels of Hb, Ht and the number of red blood cells behave the oscillations between normal limits for C_{1+} cyprinids, with notable differences between three species. In common carp, the values of all three indices from the research variant maintained with 11-12% lower than in the control variant, to the antipodes being bighead carp, in which all indices have in variant of research the bigger values with 11-32% than the control. This suggests that in common carp, respiratory functions accommodation is canalized less on quantitative line, rising on Hb quantity and more on qualitative line, the Hb capacity rise to bound the oxygen, and in bighead carp the tendency is reverse. In silver carp, the Hb values and the erythrocytes number are less with 8-23% in variant of research than to the control, while the hematocryte is with 13% elder than to the control variant, in correlation with the MCV values, which are with 43% bigger than to the lot of research.*

Key words: cyprinids, hematological indices, antiparasitical treatments

Introduction

It is well known the special signification of the usual hematological parameters values on the physiological general state at large fishes and on them particular state of health. Broadly, the states of disease are associate with the installation of some modifications in the blood composition, as often as marked by

a general hematological insufficiency (severe diminish of hemoglobin level, hematocyte value, as well as the number of erythrocytes/ μ l). Anything disturbs the medial conditions, inclusively one referring to the amount and the quality of available food or the proliferation of a specified parasitosis (Vulpe, 2004; Vulpe *et al.*, 2007), depending on graveness and duration of act, can become the stressors for fish (Scott & Rogers, 1981; Bejerano, 1984; Misaila *et al.*, 2004; Misaila *et al.*, 2005).

The stress condition can be diagnosed and estimated with big easiness through the study of the main hematological indices values. After the alert phase, wherewith begins the subjected to stress animals behavior, installs a period in which fish try to adapt, and the process of accommodation is very complex, developing inclusively in physiological plan. Some of physiological mechanisms of accommodation, such as increase of the efficiency of respiratory function can be elucidated through the hematological indices values, inclusively the derivative erythrocytary constants (Lane, 1979).

The present work has as objective the study of hematological responses of some cultured cyprinids - common carp (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) - in case of application of a preventively antiparasitic treatment, with special reference to the fish's physiological general state in the end of the active growth period.

Materials and Methods

The researches were developed along a period of 220 days (3 April - 9 November 2007) and they took place "in field", that is to the production scale, at Aquaculture and Aquatic Ecology Research Station, Iași. The two ponds were stocked up at 3 April 2007, in the polyculture system (75-83% common carp, 9-13% silver carp and 8-12% bighead carp), with a total effective of 10. 000 pieces of 50-52 g/piece in common carp, 121-128 g/piece in silver carp and 127-141 g/piece in bighead carp. In one variant was applied the antiparasitic treatment, both prophylactic one in the stock up moment, and along the active growth period (Trichlorfon in preventive doses of 0.1 mg/l in two steps and Calcium hypochlorite 2 kg/ha two times/week), and in control pond did not administered treatments.

Fish feeding was made normally, with concentrated granulated fodder, the daily ratio provided representing 3-5% of the existing piscicultural biomass. In each variant, the amount of food was divided into two semi-ratios, administered at 8.30 and 13.30, respectively. Periodically, on the basis of control weighing, performed each month (on May 21, June 12, August 13, September 10, October 5 and November 9), the amount administered food was updated.

In the first 135 days of the experiment, both variants were fed with the intensive 38/12 SAPROFISH recipe, containing 38% crude protein, 3.5% cellulose, 8% humidity and 12% fats while, in the following 85 days, the 32/SA SAPROFISH recipe (32% crude protein, 7% cellulose, 13% humidity and 8% lipids) was applied.

In the end of experimental period samples blood were collected, through the oblique resection of the caudal footstalks method, in a zone located between anal and caudal fin. These samples alternative withdrawn in the fishes of two variants, so that time “for wait” is comparable, and the slaughter fishy couples to done about to same hour. Hemoglobin (g Hb/dl) measured by Sahli hemoglobinmeter, microhematocryte (Ht%) evaluated through the centrifugal capillaries to 12. 000 rpm, and number (E) of erythrocyte ($RBC \times 10^6/\mu l$) read microscopically, in a Bürker-Türk hemocytometer, using the Hendricks reagent as a dilution way. It was determinate the following erythrocytary constants by computation: $MCV (\mu m^3/erythrocyte) = Ht \times 10/E$; $MCH (pg \text{ Hb}/ erythrocyte) = Hb \times 10/E$ and $MCHC (g \text{ Hb}/100 \text{ dL erythrocyte amount}) = Hb \times 100/Ht$.

Results and Discussions

Through the way in which he is implicated in normal hand-running of the main organism functions, the blood represents a messenger of big faithfulness in the emphasis of fish’s physiological general state. The main hematological indices with signification for the emphasis of nutritional statute (the state of upkeep) of fishes, as well as their state of health are: hemoglobin concentration (g Hb/dl blood); the percentage of figurative elements, that is the hematocryte (Ht) and the erythrocyte density (mil./ μl). To these are added the values of erythrocytary constants (MCV, MCH and MCHC), through these is can appreciated as much the anemia type if this is present in population, quotient the direction of adapts the fishes respiratory functions to the water oxygenation concrete conditions.

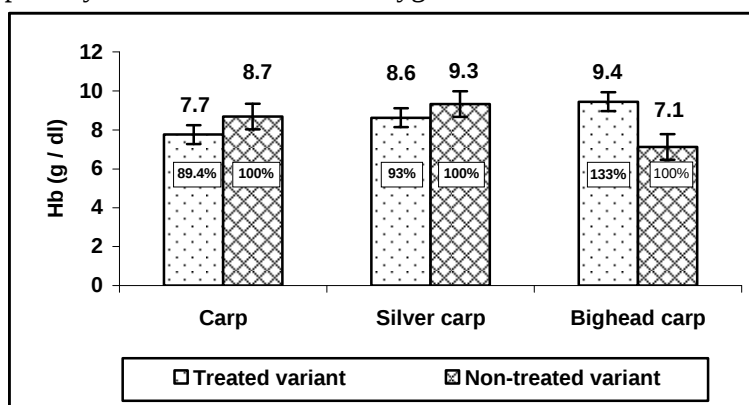


Fig.1. Comparative hemoglobin level (g/dl)

Concerning the comparative level of these indices in the fishes from experiment is ascertained a different response, so in a species to another, quotient from an experimental variant to another. For instance is noticed the fact that, in both experimental variants, as much the mean values of hemoglobin and hematocryte, quotient one the number of erythrocytes behave oscillations contained

between normal limits of variation for two summer-old cyprinids (Ghittino, 1995; Misaila, 1998). From this point of view, we can appreciate that, in general lines, the fish of both variants maintained as much as the physiological general state, quotient as the potential of bodily growth between normal limits of variation, with some observations for each species in part.

In the common carp case, for instance, as much mean concentration hemoglobin and the hematocrite, quotient the number of erythrocyte from variant of researches (fig. 1-3) maintained with 11-12% the less than one from control, suggesting a direction of adapts of the respiratory function based less on the growth of Hb amount and much more of he respiratory pigment “quality” increase, that through the growth of his capacity (efficaciousness) bound the oxygen. The assertion is supported by the supplementary weight gain, which is superior with 25% to the research variant *versus* to the control and the FCR (food conversion ratio) values, which are with 26% more efficient in the treated group *versus* control (Misaila *et al.*, 2008).

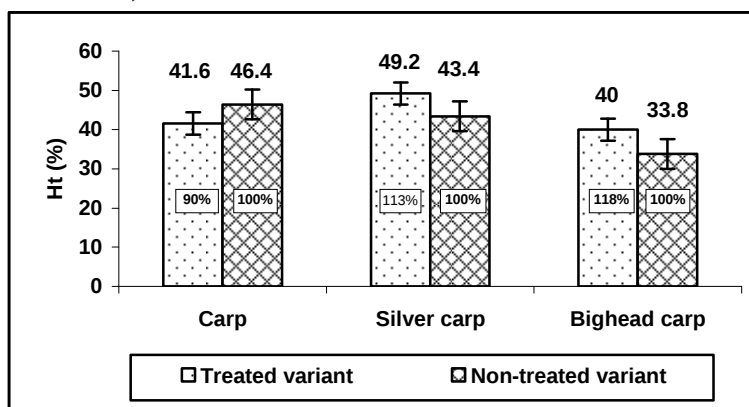


Fig.2. Hematocrite average values (%)

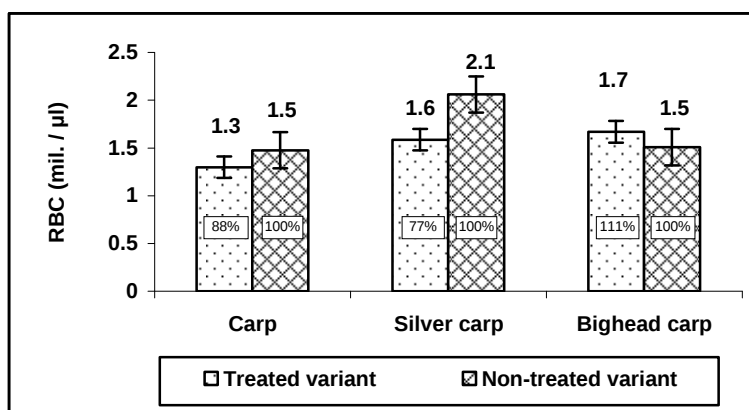


Fig.3. Erythrocytes number (mil. / µl of blood)

These performances are realized with an easy diminished concentration of Hb, but probable much more active as the respiratory potential against from variant of reference.

The Ht values in common carp is correlated to the number of red blood cells, while the erythrocytary constants have levels near identical in the two variants of study.

In silver carp, the mean values of Hb from variant of work are with 7.5%, and one of number of erythrocytes with 23% less than one from control (statistically significant), while the hematocryte has the values with 13.4% bigger than one from control.

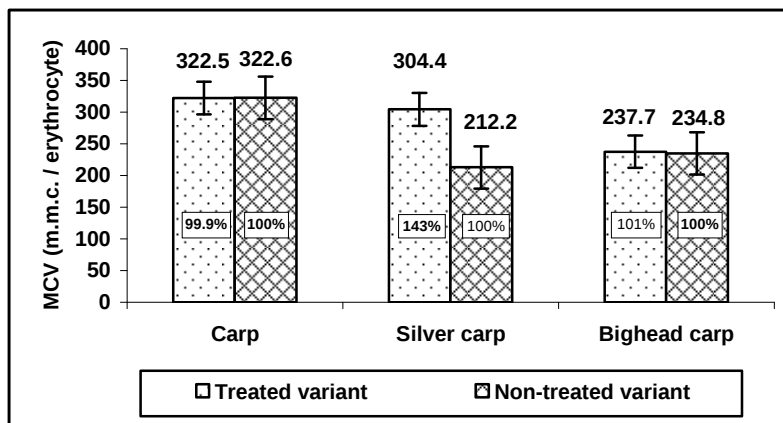


Fig.4. Mean cell volume (MCV)

Fish from this species compensatory adapted through that red blood cells from variant of research are with 43% much voluminous (MCV) than one from control (difference statistically significant), correlate with Ht, and the mean cell hemoglobin (MCV) values are with 20% bigger than to the control (statistically significant).

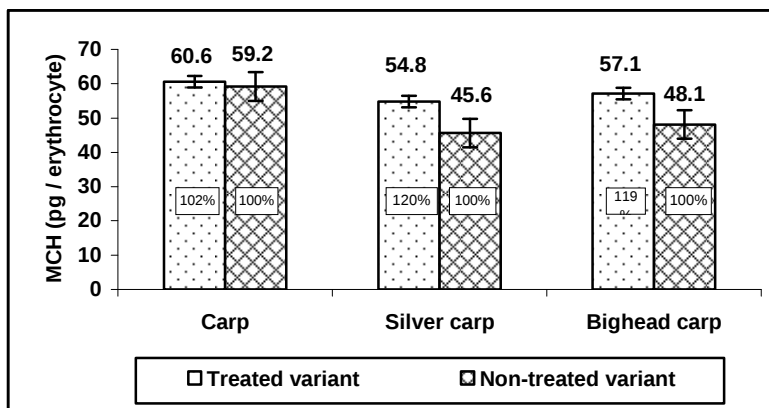


Fig.5. Mean cell hemoglobin (MCH)

In the case of bighead carp, at variant in which was applied the antiparasitic treatment it was evidenced a growth against control, as much to hemoglobin level (32.6%), difference statistically significant, and hematocryte (18.3%), as well as the number of erythrocytes/ μ L (10.6%), MCH (18.6%) and MCHC (17.5%). Rising of hematocryte values in the fish of variant of research, as much in silver carp (13.4%) quotient in bighead carp (18.3%), as well as the general hematological prosperity noticed in bighead carp from variant of research in report with control, suggests the fact that, as opposed to the common carp, the Chinese species are adapted for the concrete conditions of oxygenate water else less than on qualitative line of the increase of pigment capacity to bound the oxygen and much more on line of hemoglobinsynthesis augmentation therefore of hemoglobin amount.

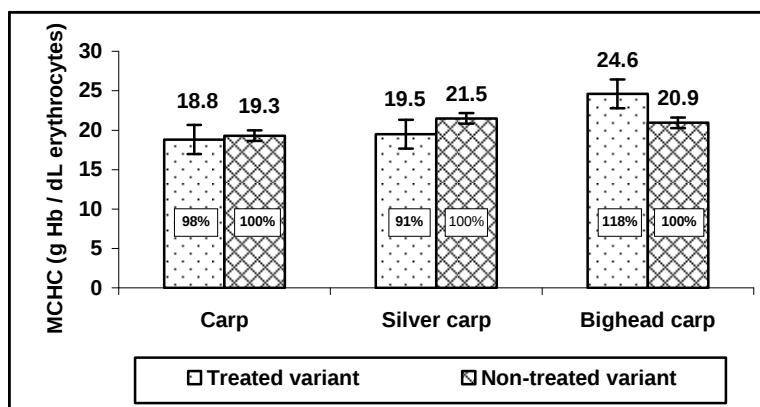


Fig.6. Mean cell hemoglobin concentration (MCHC)

Conclusions

1. In both variants taken into study, as much the Hb and Ht values, as well as the number of erythrocytes behave the oscillation between normal limits for cyprinids C_{1+} .
2. In common carp, all indices are maintained to values with 11-12% less in variant of research than to the control. Therefore, the adaptation is directed less on quantitative line (enhance the amount of Hb) and more on qualitative line (enhance the Hb capacity to bound the oxygen).
3. In silver carp, the Hb values and number of erythrocytes are less with 8-23% in variant of research than to the control, while the hematocryte is with 13% elder than to the control (correlation with MCV).
4. In bighead carp, all three indices have superior values with 11-32% in variant of research comparative with the control (the adaptation is done prevailingly on quantitative line).
5. The MCV values in common carp and bighead carp are comparable in two variants, while in silver carp the treated group has erythrocytes with 43.1%

much voluminous than from the control. In all three species the MCH values are with 2.2-20.1% bigger in variant of research comparative with the control, and MCHC values are with 2.5-9.4% less to treated group *versus* with control in the case of silver carp and common carp and with 17.5% superior than control to bighead carp (adaptation on quantitative line).

Bibliography

1. **Bejerano, I.** (1984) - *Detection and control of stress conditions in warm water aquaculture*, Res. on Aquacult. European Mariculture Society, Bredene, Belgium, 56-68.
2. **Ghittino, P.** (1995) - *Tecnologia e Patologia in Aquacoltura*, Vol. 2, Patologia, Tipo Emilio Bono, 695 p.
3. **Lane, H. C.** (1979) - *Progressive changes in haematology and tissue water of sexually mature trout (*Salmo gairdneri*.) during the autumn and winter*, J. Fish Biol., 15, 425-436.
4. **Misăilă, C., Misăilă, Elena Rada** (2004) - *Cercetări hematologice la unele ciprinide de cultură în condiții de stres cronic*, Lucr. Științifice, Seria Zootehnie, Edit. "Ion Ionescu de la Brad" Iași, vol. 47, 703-709.
5. **Misăilă, Elena Rada** (1998) - *Cercetări biochimice și ecofiziologice asupra profilului metabolic la unii pești de cultură*, Teză de doctorat, Univ. "Alexandru Ioan Cuza", Iași.
6. **Misăilă, Elena Rada, Misăilă, C., Artenie, Vl., Simalcsik, F.** (2005) - *Effect of the chronic stress on some parameters of the metabolic-blood profile (MBP) of the farming Cyprinides* in: Fisheries and Aquaculture Development, XXX, HAKI, Hungary, 147-153.
7. **Misăilă, C., Colesniuc, A., Grigorică, Elena, Răileanu, Petronela** (2008) - *Growth stimulation and food capitalization in cyprinides by control of the parasitic stress*, Lucr. Științifice, Seria Zootehnie, Edit. "Ion Ionescu de la Brad" Iași, vol.51 (sub tipar).
8. **Scott, A. L., Rogers, S. W. A.** (1981) - *Haematological effects of prolonged sublethal hypoxia on channel catfish (*Ictalurus punctatus*)*, Raf. J. Fish Biol., 18, 591-601.
9. **Vulpe, V.** (2004) - *Mixosporidioze la crapul comun crescut intensiv*, Lucr. Științifice, Edit. "Ion Ionescu de la Brad" Iași, vol. 47 (6), 731-734.
10. **Vulpe, V., Oprean, O. Z., Lazăr, M.** (2007) - *The morphologic and diagnostic value of some inflammatory dermatopathies*, ISFP VII, Parasitologia, vol. 49, suppl. 2, Rome.