Current Trends in Natural Sciences Vol. 6, Issue 12, pp. 10-15, 2017

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

THE INFLUENCE OF THE TEMPERATURE AND THE WATER HARDNESS ON THE TOXICITY OF HERBICIDE FUSILADE FORTE 150 EC TO PRUSSIAN CARP (*CARASSIUS AURATUS GIBELIO* BLOCH 1782)

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Abstract
The temperature is an important physical parameter, playing the role of a natural catalyst, activator, restrictor and selector of the aquatic life.
This study has been carried out in order to analyze the effects of the concentrations of the Fusilade Forte 150 EC herbicide (0.004 ml Fusilade Forte 150 EC/1 water, 0,008 ml Fusilade Forte 150 EC/ l water, 0,016 ml Fusilade Forte 150 EC/ l water) and calcium chloride (200 mg/l water, 400 mg/l water) on some physiologic indicators on the carp.
The hardness of the water does not significantly influence the oxygen consumption of the carp individuals that are exposed to the action of the herbicide.
The herbicide has had an inhibiting effect on the studied parameters for all the used concentrations, the toxic effect being less pronounced at high temperatures.

Keywords: breathing rhythm, carp, Fusilade Forte 150 EC, oxygen consumption, red blood cells.

1. INTRODUCTION

The thermic factor represents one of the most important ecological factors to which the living organisms have had to adapt in order to maintain an optimum level of the vital functions. As well, the temperature is one of the most significant factors that influence the toxicity of substances. Its influence is manifested both on the organisms and the external environment, the water (Botnariuc and Vădineanu, 1982).
As most of the aquatic organisms are poikilothermic, it was expected that the temperature of the water to influence the metabolism and the survival and reproductive capacity of these organisms. The water content of mineral salts and their nature influences the toxicity of some substances in a very significant manner (Mălăcea, 1969).
The herbicide treatments have complex effects on the biota. In the aquatic environment, they are proven to be toxic, not only for the aimed plants, but also for numerous species of animals (Ioanid, 1965).
In hard waters, the toxicity of some substances is lower than in soft water, due to the chemical reactions that happen, which, in hard waters can lead to a fixation of the toxic ions in dissoluble combinations and to their precipitation (Mălăcea, 1969).
Fusillade Forte is a systemic post-emerging herbicide, very active in the fight against the annual and the perennial herbage in the wide-leaf cultures. It is rapidly absorbed through the foil apparatus and

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translocated through the whole plant, towards the growing tops of the roots and the shoots. The herbage stops growing in several days from the usage; they get red, then comes the necrosis and the decomposition of the growing tops. The active substance of the herbicide is fluazifop-p-butyl150 g/l.

2. MATERIALS AND METHODS

We carried out experimental variants using the carp as test-animals (*Carassius auratus gibelio* Bloch 1782), a common species in the Arges Rives and the ponds arount.

The experiments were made at 6-8 ^{o}C in the case of the variants that were kept in the refrigerator and respectively 18-20˚C in the case of the variants that were kept at the laboratory temperature (10 specimens/ experimental lot). The acclimation of the fishes to the laboratory conditions had been made during 14 days in glass aquariums with a capacity of 100 l, continuous light (from the refrigerator), respectively 8-12 hours in the case of the laboratory fishes. The fishes had not been fed during the whole experiment, thus avoiding the intervention of the food factor. Working concentrations were established after the passing through the literature and the making of the survival tests (for each experimental variant, we carried out the limit test, with 100 mg product/l water, as it is recommended by the toxicity tests used in the European Union). The solutions in the aquarium were changed at 24 hours, the testing modality being the semi-static one.

The determination of the oxygen consumption was made using the Winkler method at 24, 48, 72, 96, 168 and 336 hours.

The determination of the breathing rhythm was made during the maintenance of the fishes for the Winkler method, carrying out successive determinations of this index using a chronometer, until three close values had been reached (their average value represented the breathing rhythm at the moment). The determination of the breathing rhythm was made at 24, 48, 72, 96, 168 and 336 hours. The determination of the red blood cells were made using a Thoma numbering camera through the method described by Picos and Nastasescu (1988), from blood prelevated from the caudal artery. The red blood cells were determined after two weeks since the toxic exposure.

3. RESULTS AND DISCUSSIONS

The following figures present the results reached subsequently to the research regarding the action of the Fusilade Forte 150 EC herbicide in 0.004 ml Fusilade Forte 150 EC/ l water, 0.008 ml Fusilade Forte 150 EC/ l water, 0.016 ml Fusilade Forte 150 EC/ l water concentrations on the oxygen consumption, the breathing rhythm and the number of red blood cells.

By analyzing the results reached at the temperature of 6-8°C, respectively 18-20°C, regarding the oxygen consumption of the fishes exposed to the actions of different concentrations of herbicide, we notice a higher resistance of the fishes at low temperatures.

The values of the oxygen consumption 14 days after the exposure of the fishes to the toxic substances display a stronger action of the herbicide at the room temperature (where decreases of the oxygen consumptions were registered, of 21.16%, 31.48% and 37.58%).

The decrease of the energetic metabolism of the carp can also be attributed to the blood changes, which are the result of the herbicide action. Ahmad et al. (1995) have reported significant decreases of the haemoglobin at the trout fishes exposed to a non-lethal mancozeb dose, which led to the reduction of the oxygen quantity which reaches the tissues and a decrease in the animals energy production.

The breathing rhythm of the carps exposed to the action of the different Fusilade Forte 150 EC and $CaCl_2$ concentrations, at the two temperature levels, has registered a constant decrease, being more

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significant as the concentration went higher. This is in compliance with the data in the literature which emphasize the less toxic effect of the herbicide as the temperature decreases.

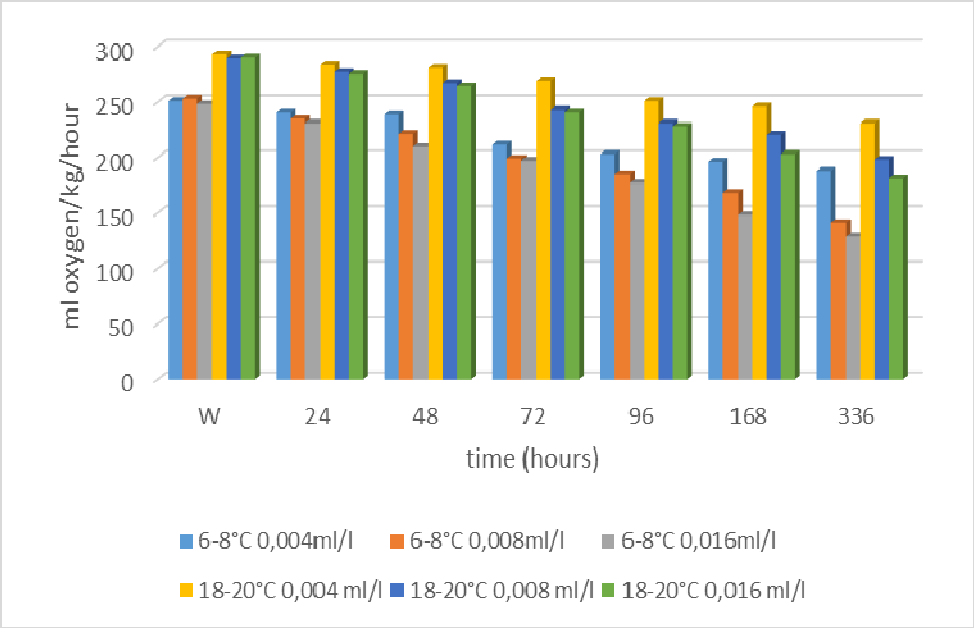

Figure 1. The influence of the Fusilade Forte 150 EC herbicide on the oxygen consumption at the carp (Carassius auratus gibelio Bloch) at different concentrations at two thermic levels

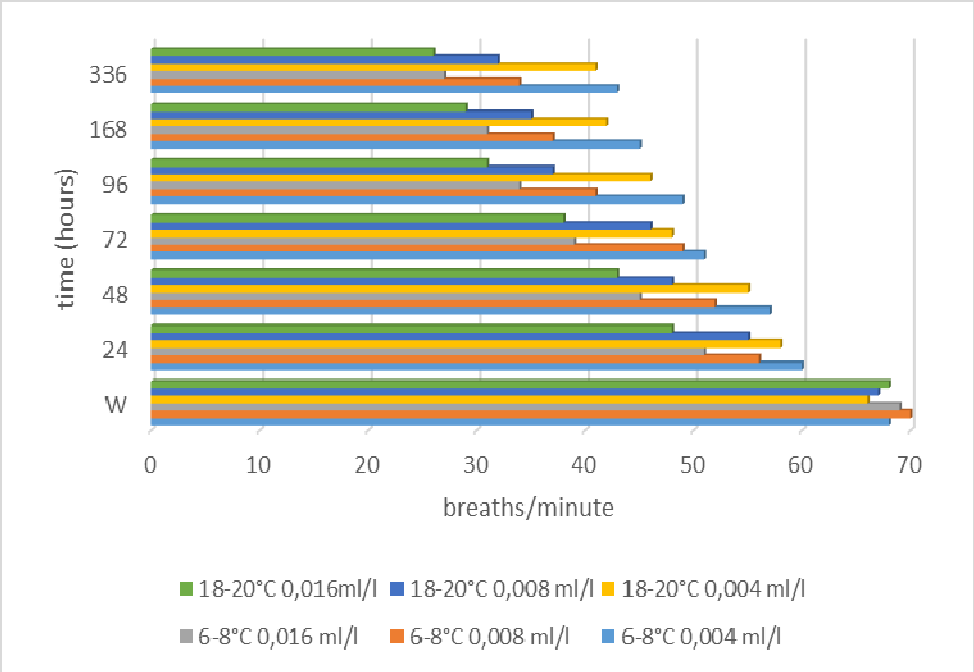

Figure 2. The influence of the Fusilade Forte 150 EC herbicide on the breathing rhythm of the carp (Carassius auratus gibelio Bloch) at different concentrations at two temperature levels

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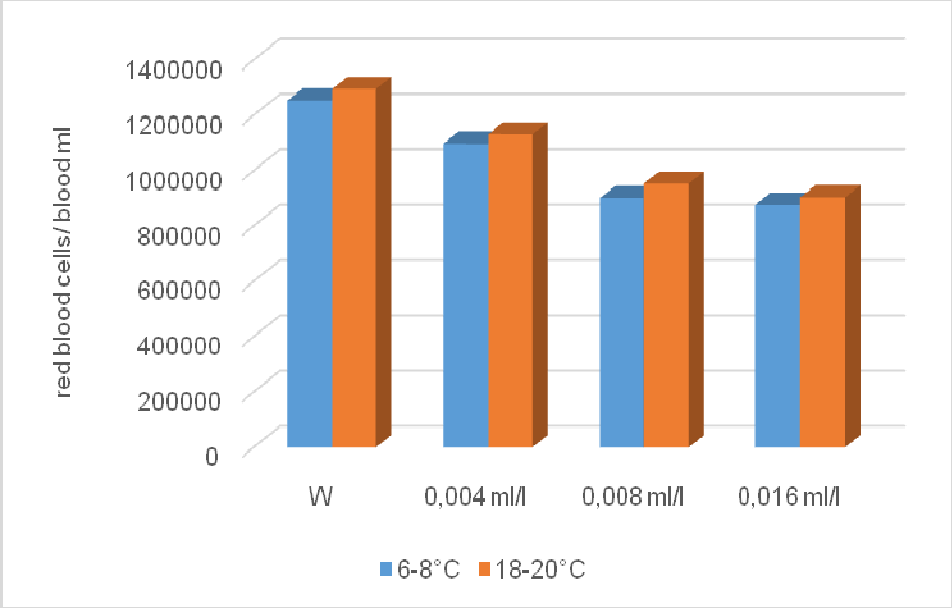

Figure 3. The number of red blood cells for the carp (Carassius auratus gibelio Bloch) 14 days after the exposure at different concentrations at two temperature levels

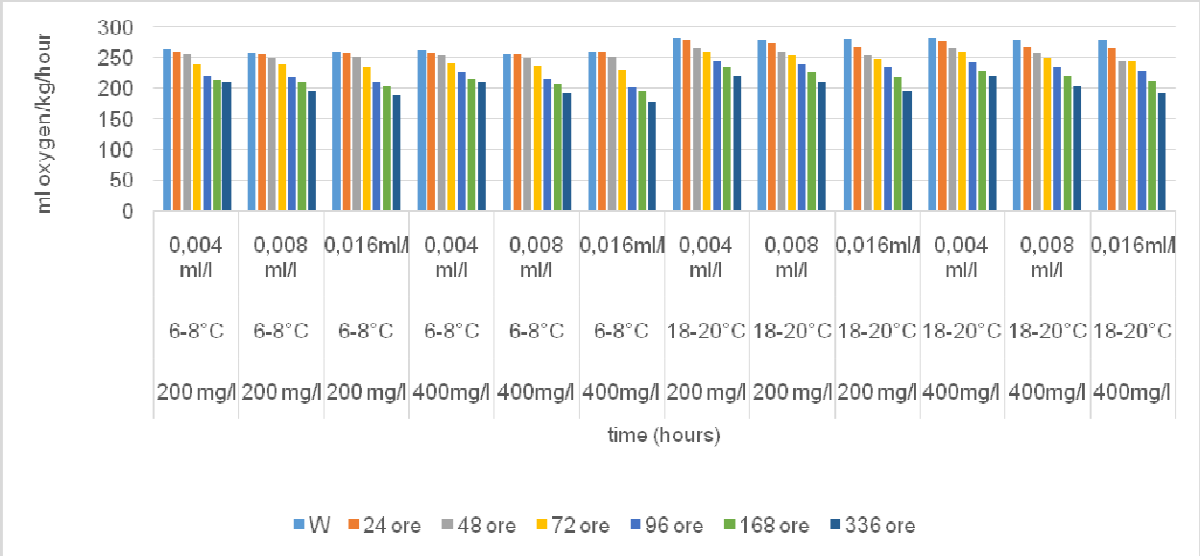

Figure 4. The influence of the water hardness on the energetic metabolism of the carps intoxicated with Fusilade Forte 150 EC at different concentration for two temperature levels

The decrease of the breathing rhythm reaches its peak after 14 days of contact with the herbicide with a concentration of 0,016 ml/l.

For both temperature levels, for all the variants where the red blood cells were numbered, we noticed the decrease of this physiologic parameter.

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Sachsse et al.(1979) report the decrease of the red blood cells and the haemoglobin volume after 4, 8 and 13 weeks of intoxication of the mice with propiconazole in high doses. Similar mailfunctions associated to the propiconazole administration were registered for mice and rabbits (Inchem, 1987).

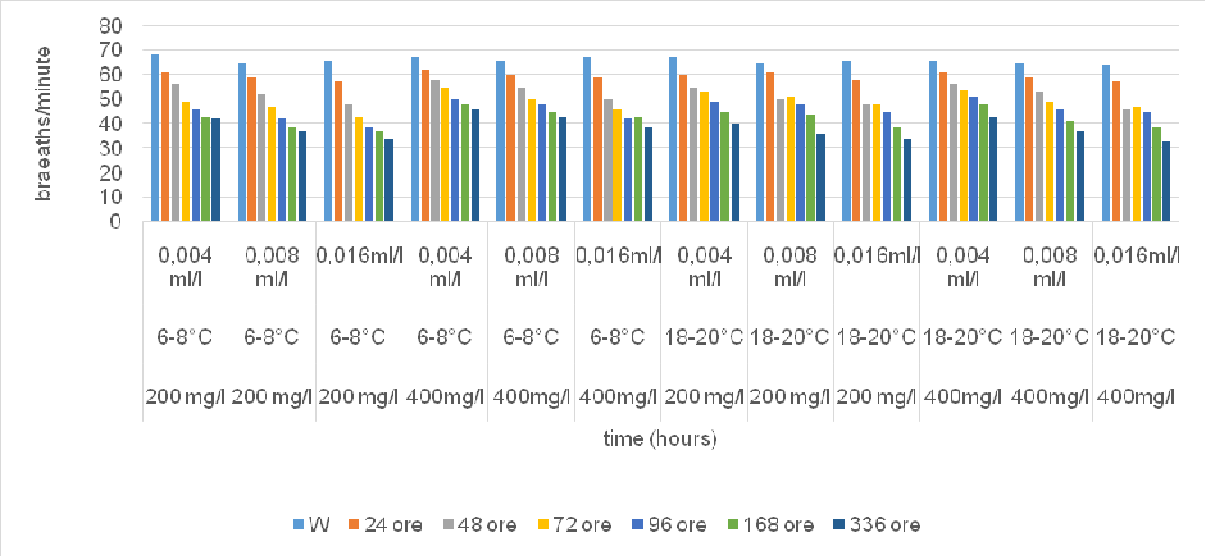

Figure 5. The influence of the water hardness on the breathing rhythm of the carps intoxicated with Fusilade Forte 150 EC with different concentrations at two temperature levels

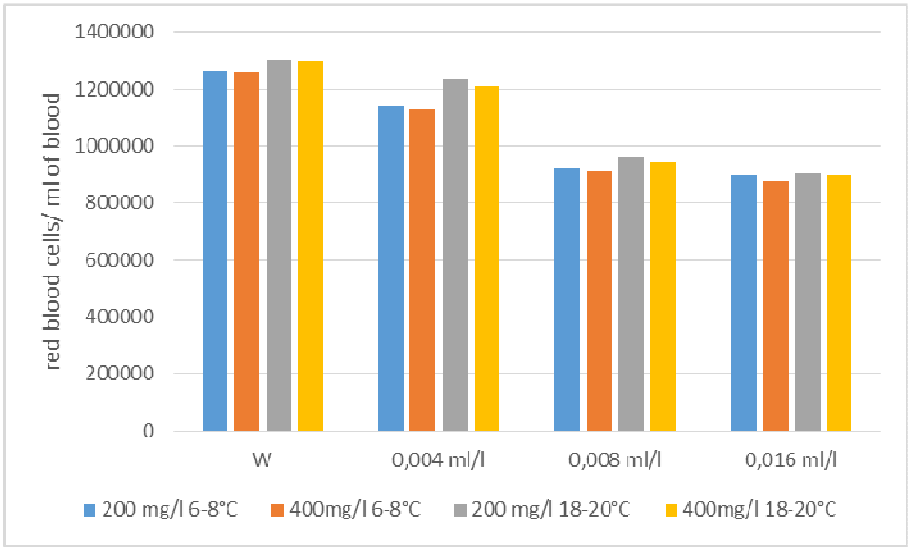

Figure 6. The influence of the water hardness on the number of red blood cells of the carps intoxicated with Fusilade Forte 150 EC in different concentrations at two temperature levels

4. CONCLUSIONS

For all our variants made at the room temperature, the values of the oxygen consumption, determined after 7, respectively 14 days from the exposure to the herbicide are lower compared to

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the witness values (the decrease of the values of this physiological parameter growing at the same time with the growth of the herbicide concentration and calcium chloride).

The temperature is one of the most important factors that influence the toxicity of substances. The exposure of the fishes for 14 days to the herbicide had resulted in the decrease of the oxygen consumption, excepting the first variant where the difference reported to the witness is not significant.

The hardness of the water does not significantly influence the oxygen consumption of the carp individuals that are exposed to the action of the herbicide.

In all the experimental variants, we noticed the decrease of the red blood cells, the most significant decrease being at the concentration of 0,016 ml Fusilade Forte 150 EC/ l water and 400 mg $CaCl_2$ / l water.

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