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INFLUENCE OF COPPER IONS TO THE PULMONARY RESPIRATION OF THE GREAT RAMSHORN *PLANORBARIUS CORNEUS* (LINNAEUS, 1758) ALLOSPECIES (MOLLUSCA: GASTROPODA: PLANORBIDAE) FROM THE UKRAINIAN RIVER NETWORK

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Soon after XX century the antropogenic pollution of natural water bodies of the middle Europe has become significant [3, 5, 8]. In Ukraine, these pollutants, which are highly dangerous for many species of water animal bionts, include ions of various heavy metals, entering water bodies as part of manufactural sewage [1, 6, 7, 11]. These are very dangerous toxical agents for the freshwater aerobic animals, including molluscs in particular Pulmonata. Heavy metal ions including copper ions are soluble in water endogenic, highly poisonous toxicants, which locally effects on integumental superficial epithelium and pulmonary respiratorium epithelium of all Pulmonata [9, 10], including *Planorbarius corneus* s. lato allospecies – "western" and "eastern". It is necessary to note that this great ramshorn is one from the widely spread and numerous from Gastropod molluscs in Ukraine river system.

The purpose of our investigation was to note the resemblance and distinction in effects of various concentrations of copper ions of water medium on the activity of pulmonary respiration of *P. corneus* s. lato allospecies.

Samples were taken (June 2021) in two localities – "western" allospecies in Sluch River (Gorodnica, Zhytomyr region): 50°48'21.74"N; 27°18′37.36"E and "eastern" allospecies in Sula River (Markovca, Sumy region): 50°52′08.44"N; 34°23′27.01"E. The total number of samples per first locality was 55 and per second locality – 61 specimens, respectively. The main method used was hand-collecting from river bottom and the surface of water plants. The collected material was identified conchologycally [3, 4]. The duration of molluscs to laboratory conditions was 14 days: the volume of aquarium was 20 L, with planting density of 5 specimens L^{-1}, water temperature 21–23° C, pH 7,2–7,8, oxygenation 7,8–8,6 mg $O_2 \cdot L^{-1}$. The environment was replaced across two days. The molluscs were fed by soft vegetation from places of their sampling (*Myriophillum spicatum* L., *Alisma plantago-aquatica* L., *Cladophora* sp.).

Toxicological study is performed to laboratory analyze *in vivo* the effect of $CuCl_2 \cdot 2H_2O$ in water medium in concentrations 0,5 MPC, MPC, 2 MPC, 3 MPC (in count on Cu^{2+}) by [2].

The obtained results of the research were processed by the methods of basic variation statistics using the computer program "Statistica 6.0" and are presented in Tables (1 and 2).

Table 1

The influence of Cu^{2+} on the pulmonary respiration of *P. corneus* s. lato allospecies

Toxicant's concentration	n	Quantitative of "inhales" per 24 hours	Interval between of "inhales", min	Duration of "inhales", min	Volume of "inhales", quantative of bubles
		$M \pm m_x$	$M \pm m_x$	$M \pm m_x$	$M \pm m_x$
"Western" allospecies					
0 MPC	10	16,19±1,17	55,21±1,18	21,98±1,13	21,24±1,12
0,5 MPC	13	17,07±1,20	53,19±1,19	22,57±1,25	20,99±1,19
MPC	13	18,33±1,14	39,20±1,22	23,99±1,34	23,38±1,31
2 MPC	10	20,49±1,33	49,15±1,23	26,85±1,28	28,75±1,30
3 MPC	9	13,80±1,21	78,49±1,38	12,12±1,07	10,14±1,01
"Eastern" allospecies					
0 MPC	10	15,03±1,09	56,59±1,19	19,68±1,17	16,81±1,13
0,5 MPC	12	15,90±1,18	60,10±1, 23	20,91±1,34	18,01±1,22
MPC	17	16,16±1,23	56,57±1,26	22,41±1,23	21,37±1,23
2 MPC	15	18,37±1,51	48,48±1,35	26,03±1,08	26,11±1,31
3 MPC	7	11,13±1,29	101,15±1,42	11,12±1,15	8,23±1,25

At 0,5 MPC Cu^{2+} in water medium containing experimental molluscs, there were no statistically significant changes in parameters of their pulmonary respiration compared to control (Table 1). It is latent phase of poisoning of these hydrobionts. Increasing the concentration of this toxicant to MPC and to 2 MPC was accompanied by sharp growth all respiration parameters except intervals between of "inhales" ($p \leq 0,05–0,001$). At 3 MPC copper ions there were the sharp fall of all respiration parameters on background of increase the intervals between in "inhales" ($p \leq 0,001$). The main reason of these changes in respiratory function of great ramshorn allospecies is damage inflicted by copper ions on the pulmonary respiratory epithelium. These effects highly intestified production of mucus and formation of thick layer of coagulation mucus which completly blocks oxygen induces into cells of pulmonary epithelium.

Table 2

The mortality (%) of *P. corneus* s. lato allospecies in various stages of poisoning by copper ions

Toxicant's concentration	Phase of poisoning	Mortality, %	
		"Western" allospecies	"Eastern" allospecies
0,5 MPC	indifferental	0	0
MPC	stimulate	0	0
2 MPC			
3 MPC	depressive	0	1
	submortal	7	19,5
	mortal	100	100

Results represented in Table 2 testify that “eastern” allospecies is more sensitive and less steady that “western” allospecies in the case influence to them equally concentrations of toxicant. This may be due to their existence in different climatic conditions. In the “eastern” allospecies they are more unfavorable due to the higher aridity of the climate within its range.

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