

## Survival of medical leeches after partial cannibalism

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### Abstract

In the experiment, 500 medical leeches, three types: *H. verbana*, *H. medicinalis*, *H. orientalis*. The experiment was carried out for half a year, on leeches of middle and mother age. The leeches were set aside by 8-10 pieces in a tank with water after blood feeding, the survival rate after the manifestation of partial cannibalism was investigated. As a result, we found that the survival after all wounds in all three types was about 35%. After the wounds had healed, survivors of leeches developed constrictions at the wound site, which remained with them for life. It should be noted that partial cannibalism was observed in all three types of medicinal leeches, as well as in one species, and between species.

**Keywords:** survivability of medical leeches, partial cannibalism, hematophagus, blood, ectoparasite

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### INTRODUCTION

Medical leeches (ML) are ectoparasitic hematophagous, quite sensitive to chemical pollution, which makes them an ecological indicator of habitat and are of practical value for medicine, veterinary medicine, pharmaceuticals and cosmetology. (Xiao et al. 2015, Li, et al. 2016, Dong and Ren 2016, Surendranth et al. 2016, Zulhisyam et al. 2016, Valerio et al. 2017, Hosseinirad et al. 2017, Aminov and Frolov 2017, 2018, Shakouri et al. 2018, Ojo et al. 2018). ML are ringed worms (*Annelides*). Class leeches (*Hirudinea*) (Saglam et al. 2016, Saidel et al. 2018). ML are the most studied representatives of the *Hirudinea* class, due to their healing properties. ML are endemic to the Palearctic and predominantly inhabit its European part. ML - hematophagous, can suck the blood of all classes of vertebrates, preferring amphibians, cattle and humans. (Kutschera et al. 2010). Hungry leeches are observed aggressive behavior, there are cases of cannibalism. (Kutschera and Roth 2005, Merilä 2002, Mustafa and İsmail 2012, Aminov 2019). There are cases of hyperparasitism, in particular of the proboscis leech *Helobdella stagnalis* on well-fed individuals of *H. verbana* (Kutschera et al. 2010). Now medical leeches are under threat of extinction due to pollution of natural water bodies and increasing anthropogenic pressure on freshwater ecosystems (Kutschera and Roth 2005, Kutschera 2011), also other negative factors to which cannibalism can be attributed. Many species are already classified in the Red Book and are protected by law due to their extinction in many countries. The manifestation of partial cannibalism in leeches was described by many researchers. (Kutschera et al. 2005, 2010, 2011,

Mustafa and Ramazan 2019) and the percentage of survival after partial cannibalism of medical leeches of three species has been studied for the first time.

### MATERIALS AND METHODS

Studies were conducted in the educational and research laboratory of cell and organism biotechnology of Zaporizhzhya National University. The experiment was carried out for half a year on leeches of middle and mother age in an amount of 500 pieces. Piece conditions of a beat are created are similar to natural: temperature, light, food, water. The leeches were set aside for 8-10 pieces in a tank with water after feeding with blood. The replacement of water took place partially and evenly so as not to create a stressful state for them. Observations were carried out during the day and night. Attacks of leeches on others were uniform throughout the day and night with the same intensity. Statistical processing of the results was performed using parametric statistical methods using the Microsoft XP Exel application software and IBM SPSS Statistics 21.0 (USA). In the case of compliance with the normal distribution law, the signs in the studied samples were investigated by the parametric method (Student's t-criteria), and the values in the tables are presented as  $X \pm SE$ , where X is the vibration mean, SE is the standard error of the mean. Differences were considered significant at a significance level of  $p < 0.05$ .

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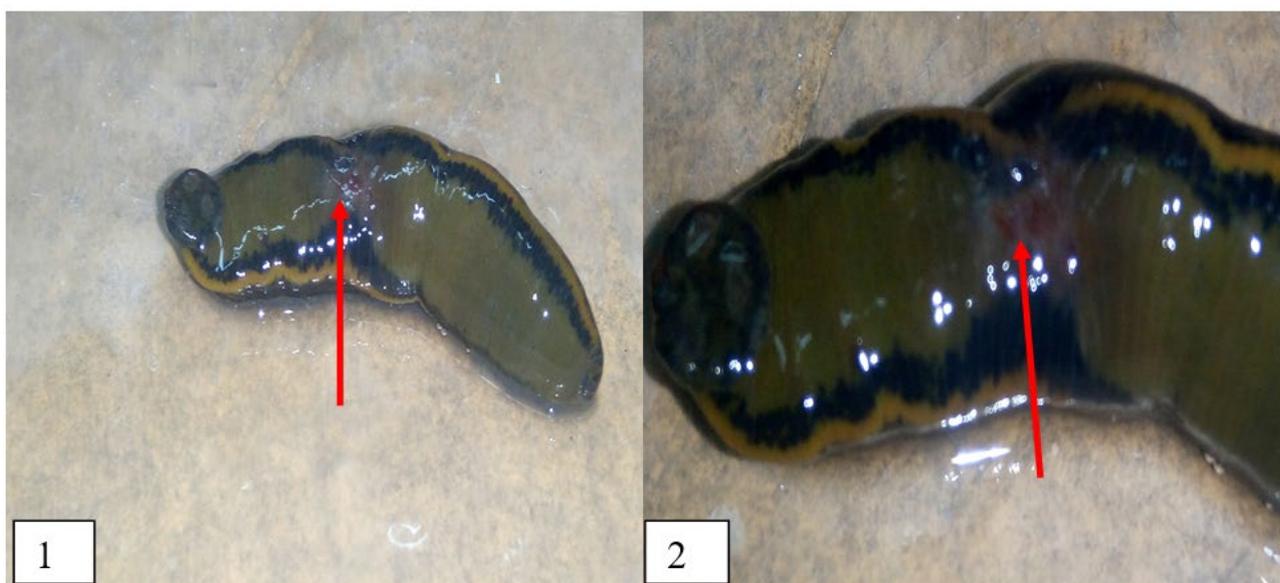
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**Table 1.** Survival of medical leeches,  $X \pm Se$ 

Animals	Survival %, n=500			
	Control	Affected epidermal layer	Affected muscle	Not only muscle tissue is affected.
<i>Hirudo verbana</i> Carena, 1820	97.3±2.3	94.6±3.1	72.1±2.1*	30.1±0.6*
<i>Hirudo medicinalis</i> Linnaeus, 1758	96.1±1.3	92.6±1.9	68.2±1.6*	27.4±0.8*
<i>Hirudo orientalis</i> Utevsky and Trontelj, 2005	97.0±1.9	93.1±2.4	66.3±1.3*	29.3±1.1*

Note: \* -  $p < 0,05$  in comparison with the control group

**Fig. 1.** Damage to the epidermal layer of the animal: 1, 2**Fig. 2.** Damage to animal muscle tissue: 1, 2

## RESULTS AND DISCUSSION

As a result, we found that the survival after all wounds in all three types was about on average 35% (**Table 1**). Partial cannibalism was manifested in the independence of how they ate blood: human or horned cattle. The wounds they left were of different depths and widths. Those leeches in which only the epidermal layer was stung, the survival rate was almost normal (**Fig. 1, Table 1**).

For those medical leeches in which the depth of wounds affected the muscle tissue, the survival rate decreased on average by 20% less than with damage to the epidermal layer (**Fig. 2, Table 1**).

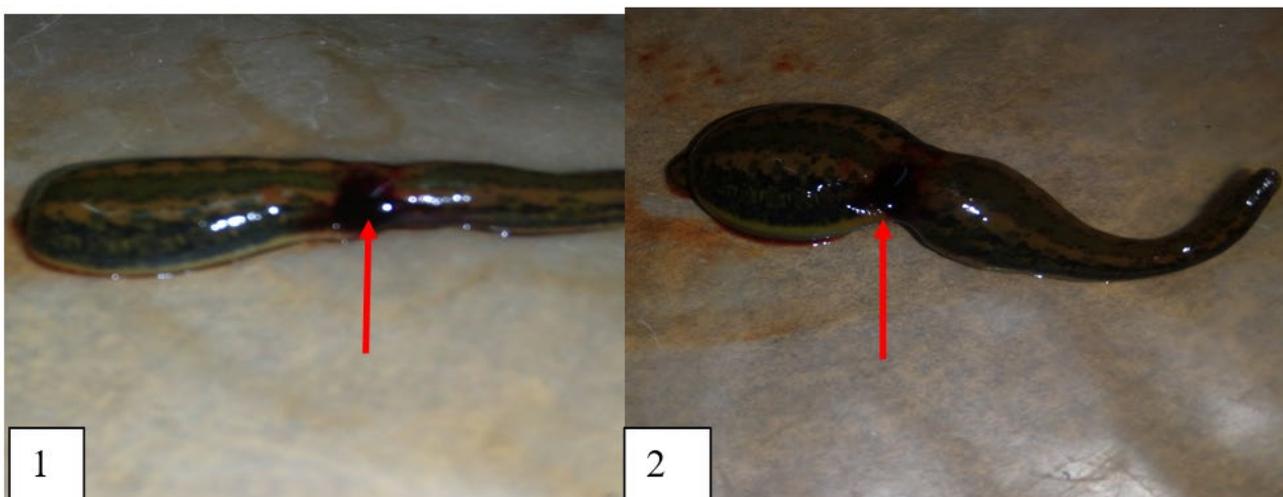
A part of the leeches which had damage not only all the muscle tissue from the wounds copiously leaked the blood they absorbed (**Fig. 3, 4, Table 1**).

Their survival rate reached an average of about 30%.

After the wounds had healed, survivors of leeches developed constrictions at the wound site, which remained with them for life. It should be noted that partial cannibalism was observed in all three types of medicinal leeches, as well as in one species, and between species. In nature, the manifestation of partial cannibalism is possibly associated with a violation of the food chain, namely a decline in the wildlife of animals. We discovered the case of the attack of a huge number



**Fig. 3.** Damage to not only the muscle tissue of the animal: 1, 2



**Fig. 4.** Abundant blood loss leeches after the attack: 1, 2

of snail leeches on humans in the wild, which indicates a decrease in food in their habitat. The decrease in the number of leeches in nature, not only medical but also of other species, may be due to many factors one of which is partial cannibalism. Our results may be useful for developing methods for preserving species of medicinal leeches in different habitats. It should also be noted that the manifestation of cannibalism in fed leeches manifested much less frequently than in hungry ones. Much more often, cannibalism was manifested if a part was hungry, and a part was fed about what was indicated in our previous work (Aminov 2019).

### CONCLUSIONS

As a result of partial cannibalism, an average of 65% die in all three types of medicinal leeches. The lowest

survival rate is observed in animals in which muscle tissue is fully affected. Their blood flows abundantly. With minor injuries in most leeches, wounds are tightened, and in their place constrictions are formed, which remain with them for life. It should be noted that cannibalism in medical leeches manifests itself both species and between species. We obtained experimental results about low survival after partial cannibalism can be one of the reasons for the disappearance of the medicinal leech in the natural environment.

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