

# *Microbiocinosis Formation in Birds Kept in Captivity*

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**Abstract**—Keeping swans in captivity leads to changes in their microbial background. The study of mucous membranes of larynx and cloaca as well as bedding and pool water aiming at investigation of composition of both residential and pathogenic microflora in swans was carried out. For this purpose cultural-biochemical, morphological, hemolytic and tinctorial properties of the obtained material were studied using general biological methods with subsequent identification of *isolated* cultures by Berdgi determinant. Microorganisms referring to 7 genera were isolated from the mucous membranes of the birds. 6 species of microbes belonging to genera *Echerichia*, *Salmonella* and *Staphylococcus* inhabit the mucous membranes of larynx and cloaca of 100% of birds under study. Three species of *Staphylococci* were found on the mucous membranes of larynx in the case of *C.olor* and on the mucous membranes of cloaca in the case of *C.bewickii* (*S. Epidermidis*, *S. Aureus* and *S. saprophyticus*).  $\beta$ - hemolytic streptococcus was found on the mucous membranes of larynx in *C. bewickii*. *Proteus* was present on the mucous membranes of larynx in *C.olor* and the mucous membranes of cloaca in *C. bewickii*. *Penicillium* and *Aspergillus* were found in lavages from the mucous membranes of larynx and cloaca correspondingly in *C.olor*. Microorganisms referring to genera *Echerichia*, *Salmonella*, *Staphylococcus* (*St. albus* and *St. saprophyticus*), *Streptococcus* ( $\beta$ -hemolytic streptococcus), *Bacillus*, *Mucor*, *Penicillium*, *Aspergillus* were isolated from the bedding and *Echerichia*, *Salmonella*, *Streptococcus* ( $\gamma$ - and  $\beta$ - streptococci) – from the pool water.

**Keywords**—Swans, microorganisms, stress, contamination

## I. INTRODUCTION

After animal birth, a newly born organism begins to contact with different microorganisms entering its respiratory and digestive ways. Different bacteria, actinomycetes, mould and yeast fungi, mycoplasma and others settle from the air on mucous membranes of upper respiratory ways from nestlings with the first inhalation. Most of the microbes are situated in anterior parts of the respiratory tract decreasing in the number towards the deeper portions, the least number settling after the bifurcation of the trachea. In several hours after incubation, the gastroenteral tract of newborns is occupied by microbes from the eggshell and nest air [1; 2; 3].

Microbic landscape depends on parents' microflora, feed, contamination of environmental objects and raising conditions. Microflora composition can change both qualitatively and quantitatively in the course of animal life [4].

Residential microflora includes lactobacteria as well as intestinal bacilli and rods, exercising antagonistic effect on pathogenic microorganisms. Lactobacteria inhabiting the intestine excrete ferments facilitating the digestion of proteins, fats and carbohydrates, as well as assimilation of

microelements, and produce indispensable aminoacids and vitamins.

The conventionally pathogenic microflora is present in the organism of both healthy birds and those recovered from different diseases. Originally entering the organism, microorganisms are in symbiotic connection with macroorganisms creating a temporary immunological equilibrium [5]. Under stresses accompanied by general weakening of the organism and decreasing of its natural protective functions, “microbial pressure” grows leading to formation of autoinfection. The latter may either take an independent course causing mass losses among birds especially the young ones or act as a secondary process [6].

Microflora composition is richer in free-living birds than in those kept in artificial environment [7; 8]. The microbial background in swans [9] kept in captivity is of interest because of their close contact with other birds species.

Therefore, the aim of this study was the investigation of the composition of both residential and pathogenic microflora of respiratory and digestive organs in swans kept in captivity in Ivanovo, as well as environmental elements contamination.

## II. MATERIALS AND METHODS

The investigation was carried out on the basis of the department of infectious and parasitic diseases, Ivanovo State Agricultural Academy named after D.K. Belyaev, Ivanovo, Russia in 2016.

The objects of the present study were three swans species: mute swan (*Cygnus olor* (Gmelin, 1789)) (6 representatives), tundra swan (*Cygnus bewickii* (Yarrell, 1830)) (6 representatives) and blacknecked swan (*Cygnus melancoryphus* (Molina, 1782)) (6 representatives) and birds environment.

Smears from the mucous membranes of larynx and cloaca, as well as lavages from bedding and pool water, served as the subject of investigation.

Cultural-biochemical, morphological, hemolytic and tinctorial properties of the material under study were investigated with the help of general microbiological methods with the following identification by Bergi determinator [10; 11; 12; 13].

Cultural-biochemical properties of the bacteria were studied on the meat-peptonic agar, meat-peptonic broth, Endo, Levin, Ploskirev, Garro, Wilson-Bler media as well as bismuth-sulphid agar. Morphological properties were determined according to microorganisms’ growth character in nutrient media. Hemolytical properties of the isolated organisms were investigated by incubation on bloody meat-peptonic agar, their tinctorial properties - by light microscope and Gram smear staining. Cultural-morphological properties of fungi were determined by colonies growth character on Chapek medium, as well as by light microscope.

## III. RESULTS AND DISCUSSION

Microorganisms found on the mucous membranes of swans are presented in tables 1 and 2, figures 1 – 7.

In the course of the study of microbial background of respiratory ways and digestive channel microorganisms referring to 7 genera were located, 6 inhabiting the larynx mucosis and equal amount of cloaca mucous membranes. Microorganisms of genera *Escherichia* (Rahn 1937), *Salmonella* (Rahn 1937), *Staphylococcus* (Rosenbach 1884), *Streptococcus* (Rosenbach 1884) were found on the mucous membranes of larynx and cloaca in 100% of examined birds.

*Escherichia u Salmonella* were found in all the birds on the mucous membranes of both larynx and cesspool. Most of the microbes referring to these genera are either pathogenic or conditionally pathogenic and are capable of disease producing under resistance reduction. The aggregate of aetiological factors promoting stress formation is 10 times higher in birds kept in captivity [4] which can lead to disease formation in invasion of even conditionally pathogenic microflora against the background of immunity decreasing.

Staphylococci microflora is represented by 3 genera: *S. epidermidis*- conditionally pathogenic staphylococcus exercising its pathogenic action under immuno-depressive conditions. According to Quinn (2011), it can cause infections in immuno-compromised humans and mouth cavity and larynx mucous inflammation in dogs [14]. *S. Saprophyticus* performs protective role inhabiting the mucous membranes is in fact the part of normal microflora. Still it can cause disbacteriosis excessively multiplying in the digestive tract.

*S. aureus* was found in mute swan probably causing pododermatitis of both legs and osteoarthritis of the left knee joint [15].

TABLE I. LARYNX MUCOUS MEMBRANES MICROFLORA COMPOSITION

Microorganisms genera	Birds species		
	<i>C. olor</i>	<i>C. bewickii</i>	<i>C. melancoryphus</i>
<i>Escherichia</i>	+	+	+
<i>Salmonella</i>	+	+	+
<i>Staphylococcus:</i>			
<i>S. epidermidis</i>	+	+	+
<i>S. aureus</i>	+		
<i>S. saprophyticus</i>	+	+	+
<i>Streptococcus</i>			
$\gamma$ - hemolytic	+		
$\beta$ - hemolytic		+	
$\alpha$ -hemolytic			+
<i>Proteus</i>	+		
<i>Penicillium</i>	+		

Streptococci found in swans are represented by three groups.  $\gamma$ -hemolytic streptococcus is present on the mucous membranes of cloaca in *C. olor* and *C. bewickii* as well as on the mucous membranes of larynx excessively in *C. olor*.  $\alpha$ -hemolytic streptococcus is present on the mucous membranes of cloaca in *C. melancoryphus*.

TABLE II. CLOACA MUCOUS MEMBRANES MICROFLORA COMPOSITION

Microorganisms genera	Birds species		
	<i>C. olor</i>	<i>C. bewickii</i>	<i>C. melancoryphus</i>
<i>Escherichia</i>	+	+	+
<i>Salmonella</i>	+	+	+
<i>Staphylococcus:</i>			
<i>S. epidermidis</i>	+	+	+
<i>S. aureus</i>		+	
<i>S. saprophyticus</i>	+	+	+
<i>Streptococcus</i>			
$\gamma$ - hemolytic	+	+	
$\alpha$ - hemolytic			+
<i>Proteus</i>		+	

$\beta$ -hemolytic streptococcus was typified on the mucous membrane of *C.bewickii* larynx .

The conditionally pathogenic *Proteus* usual for intestinal microflora was isolated from the cloaca mucous membrane of *C. bewickii*. Microorganisms from genera *Proteus* (*GustavHauser 1885*) and *Penicillium* (*Thom, 1906*) were isolated from larynx mucous membranes of *C. olor* and microorganisms from genera *Proteus* and *Aspergillus* (*Desm, 1894*) were isolated from its cloaca mucous membranes.

Microorganisms referring to genera *Escherichia*, *Salmonella*, *Staphylococcus* (*St.albus* and *St.saprophyticus*), *Streptococcus* ( $\beta$  - hemolysis ), *Bacillus* (*Ehrenberg 1835*), *Mucor* (*Fresen, 1850*), *Penicillium*, *Aspergillus* were isolated from the bedding lavages during the environmental investigation.

Microorganisms, referring to genera *Escherichia*, *Salmonella*, *Streptococcus* ( $\gamma$ - u  $\beta$ -streptococcus) were isolated from the pool water.

The bedding was considered to be much more contaminated than the pool water, *Mucor* lacking on the mucous membranes of larynx and cloaca in swans.

#### IV. CONCLUSION

It has been stated that swans living jointly in captivity have much similar mucous membranes microbial background of respiratory and digestive systems. The study proves that microorganisms of genera *Escherichia*, *Salmonella*, *Staphylococcus*, namely *S. saprophyticus* and *S.epidermidis*, *Streptococcus* ( $\gamma$  - and  $\alpha$ -hemolytic), are residential and typical of the microbial background of swans. The representatives of genera *Aspergillus*, *Penicillium*, *Staphylococcus* (*S. aureus*) and *Streptococcus* ( $\beta$  - hemolytic) are pathogenic or potentially pathogenic and are capable of producing visceral diseases as well as septic lesions. Besides, mycotoxins excreted by fungi can exercise immuno-depressing action in birds, leading to activation of the conditionally pathogenic microflora, as well as to growing of its concentration and displacement of residential microorganisms by pathogenic ones. Microorganisms inhabiting the mucous membranes of swans are present in bedding and pool water causing constant contamination of birds and following environmental pollution.



Fig. 1. Salmonella spp. Bismuth sulfite agar



Fig. 2. E.coli. Nutrient medium Endo



Fig. 3. Streptococcus spp. Blood agar,  $\alpha$ - ,  $\beta$ - hemolysis



Fig. 4. Staphylococcus spp., Streptococcus spp. Blood agar,  $\beta$ - hemolysis



Fig. 5. Conidiophores and conidia. *Penicillium* spp. Nutrient medium of Capek

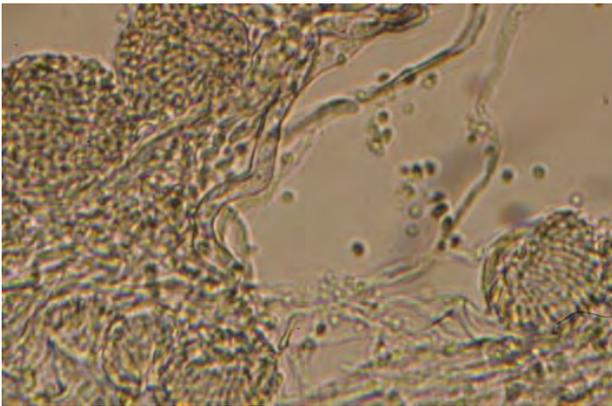


Fig. 6. Conidia and conidiophores *Aspergillus fumigatus*. Nutrient medium of Capek

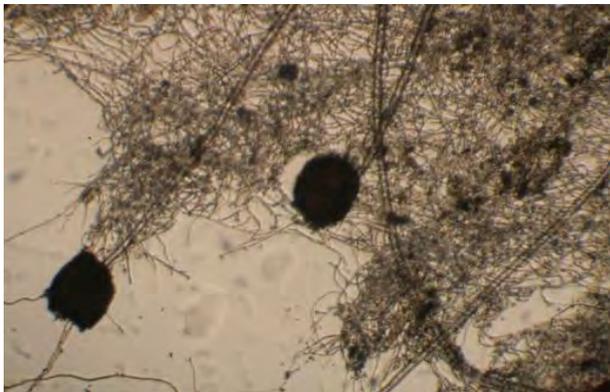


Fig. 7. Sporangiophores with sporangia. *Mucor* spp. Nutrient medium of Capek

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