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Microbial contamination of carnivorous fur animal farms

Mikrobiologiczne zanieczyszczenie ferm zwierząt futerkowych mięsożernych

Summary. The studies on biological aerosol carried out at the Arctic fox farm showed the mean concentration of mesophyllic bacteria in the examined air – 5.13×10^2 CFU/m^3, while the total bacteria count reached 4.22×10^4 CFU/m^3, which pointed to low air contamination. Among the determined microbes, there was confirmed the presence of coagulaso-negative staphylococci (CNS), Gram-negative bacteria, cocci, bacteria of *Proteus*, *Corynobacteriaceae* genus and molds of *Muco*r, *Cladosporium, Aspergillus* genus as well as *Penicillium* and *Ulocladium*. The research material including animal and environmental swabs showed the highest percentage of CNS (20.69%), while no presence of *Staphylococcus aureus* or *Streptococcus* was recorded.

Key words: bioaerosol, air, fox farm

INTRODUCTION

Fur animal farming is a sector of special agricultural production which implementing appropriate management strategy including economic rules can yield sound profit to producers. Importantly, good body condition of animal is a prerequisite for reproduction performance, high rearing index of young stock as well as best quality fox skin. Therefore, concerns over animal health directly translates into a proper level of animal welfare and consequently, economic benefits of production. Producers who are negligent in their care for animals, fail to maintain general hygiene and sanitary practices and thus may significantly contribute to disease incidence at a farm. Fur animal farms requirement for feed stock have provided a huge market for offal and feed quality and composition is of critical importance for animal breeding. However, this specific animal feeding strategy and the management conditions prove conducive to microorganism growth. Alike, in-

adequate sanitation of the breeding facilities, no control over feed quality or diseased animals or even a rodent problem may lead to microbial contamination of a unit [Tymczyna *et al*.1999, Trawińska et al. 2006, Węsierska 2006, Szeleszczuk *et al*. 2007].

The present research aim was assessment of microbial contamination at a carnivorous fur animal farm.

MATERIAL AND METHODS

The studies were conducted at the farm situated in the southern part of Poland. During the research period, ca 50 Arctic foxes (*Alopex lagopus*) as basic stock were housed at the farm. The research material comprised swabs from animals and the environment they are kept at. Swabs from animals were taken from the oral cavity, ears, eyes, belly, back, penis or vagina and anus as well as space between fingers. Whereas the other samples were collected from the animal surrounding, like feeders, waterers, cages, corridors, equipment used by the workers as well as outer and inner gate. In three points of pavilions, there was analyzed the air bioaerosol using the impact method with MicroBio impactor. At the same time, the key microclimatic parameters (air motion, temperature, relative humidity) were measured. All of the above analysis was conducted twice in each of the test periods (spring, autumn).

In the laboratory, the collected material was inoculated into the following media: blood agar, McConkey and Sabouraud agar. All the plates were incubated according to the norm [PN-89/ZO4111/02]. Microorganisms were identified micro- and macroscopically and by available tests. The results were analyzed statistically and presented in Figures.

RESULTS AND DISCUSSION

Air is by nature an unfriendly environment for microorganism to live in. Unlike soil and water, microbes stay in the air for only short time as they cannot multiply or grow there ,yet, retain their infective potential. In the best interest of human health, the risk of airborne transmitted infections should be minimized and routine monitoring of microbial contaminants performed [Burge 1990, Dutkiewicz and Górny 2002].

Analysis of material collected from the Arctic fox farm indicated medium concentration of mesophyllic bacteria – $5{,}13 \times 10^2$ CFU/m^3 in the investigated air, while total bacteria count – $4{,}22 \times 10^4$ CFU/m^3 (Tab. 1).Mean total number of fungi throughout the research period was $0{,}39 \times 10^2$ (Tab. 1). During the autumn season, there was found a higher level of bacterial and fungus aerosol. The decline was noted at puberty and growth period of juvenile animals, which are not numbered among the basic stock. According to Górny [2004], upper limits for microbial air contamination in farm facilities, subject to flooring used, range from $5{,}0 \times 10^4$ CFU/m^3 in horse barns or units for young animals up to $2{,}0 \times 10^5$CFU/m^3 in pig houses, while for fungus aerosol, the highest upper limit is reported for pig facility – $1{,}0 \times 10^4$ CFU/m^3. All the values recorded for the farm under study give evidence of its good sanitary conditions in compliance to the norm PN-89/ZO4111/02. Among the determined microorganisms, the presence of coagulaso-

negative staphylococci(CNS), Gram-negative bacteria, cocci, bacteria of *Proteus*, *Carynobacteriaceae* genus and molds of *Mucor*, *Cladosporium, Aspergillus* genus along with *Penicillium* and *Ulocladium* (Fig. 1 and 2) was found.

Table 1. Mean content of biological aerosol in air of fox farm and microclimatic indices
Tabela 1. Średnia zawartość aerozolu biologicznego w powietrzu fermy lisów oraz wskaźniki mikroklimatyczne

Sampling time Czas pobrania	Mesophyllic bacteria Bakterie mezofilne CFU/m^2	Total bacteria count Ogólna liczba bakterii CFU/m^2	Total fungi count Ogólna liczba grzybów CFU/m^2	Microclimatic indices Wskaźniki mikroklimatyczne		
				air motion ruch powietrza m/s	relative humidity wilgotność względna %	air temp. tempera-tura powietrza ^{o}C
Spring Wiosna (2 times) (2 razy)	$1{,}33 \times 10^2$	$2{,}80 \times 10^3$	$0{,}33 \times 10^2$	0,25	62	17,5
Autumn Jesień (2 times) (2 razy)	$8{,}92 \times 10^2$	$8{,}42 \times 10^4$	$0{,}45 \times 10^2$	0,34	51	8,7
Mean Średnio	$5{,}13 \times 10^2$	$4{,}22 \times 10^4$	$0{,}39 \times 10^2$	0,29	56,5	13,10

A detailed analysis of the material taken from the animals and their environment showed the highest percentage of CNS – coagulaso-negative bacteria (20,7%), coli bacteria (10,3%) and anascogenic fungi (6,9%). No presence of *Staphylococcus aureus* or *Streptococcus* was shown in the investigated material (Fig. 3). Szeleszczuk *et al*. [2007] found that abundant microbial contaminants in the carnivorous fur farms may contribute to decreased reproductive performance of animals.

Biological aerosols at farms that lack optimal microclimatic conditions may produce disorders of the respiratory system, e.g asthma, allergic pulmonary alveoli inflammation and so-called organic dust toxic syndrome (ODTS). These diseases occur at workers exposed to inhalation of dust containing mold spores.

Microbial analysis of the animal environment allows for initial assessment of its sanitary status. The studied research material comprised, besides bacterial contaminants *CNS*, *E. coli*, fungi that under conducive conditions can become human pathogens as well. The most common opportunistically pathogenic fungi developing mycoses include anascogenic fungi of *Candida* genus and molds of *Deuteromycetes* and *Zygomycete*s class. An organ particularly at risk of being exposed to fungi is skin and thus, dermatomycoses are most common.

Fig. 1. Microbes collected from air isolated on TSA medium
Ryc. 1. Drobnoustroje pozyskane z powietrza wyizolowane na podłożu TSA

Fig. 2. *Penicillium* spp. on MEA (Malt Extract Agar)
Ryc. 2. *Penicillium* spp. na podłożu MEA (Malt Extract Agar)

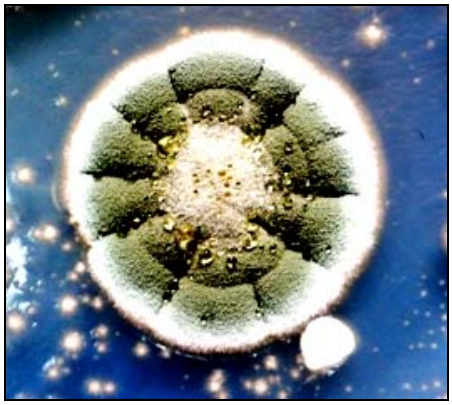

Fig. 3. *Penicillium chrysogenum* on Sabourad's medium
Ryc. 3. *Penicillium chrysogenum* na podłożu Sabouarda

Romanowska-Słomka and Mierosławski [2009] analyzing air at hen facilities indicated strong contamination by bacterial aerosol, whereas for the fungus one, it was clean on average. However, all the indices obtained imply that "the contamination can negatively affect human health". The air investigated at the poultry farm buildings was shown to contain bacteria classified in Hazard Group 2, e.g. *Staphylococcus aureus*, *Enterobacter cloacae*, *Proteus mirabilis*, *Bacillus* spp. *Streptomyces* sp. In the laying hens facilities, the microorganism counts reached 26,7 million cells/m^3 and this values, as the authors report, exceeds the top limits of air contamination with bacteria and fungi.

Tietze *et al*. [2000] found that mean air microflora concentration in dairy cow barns did not surpass 60 thousand CFU/m^3 but it varied between the objects subject to a season.

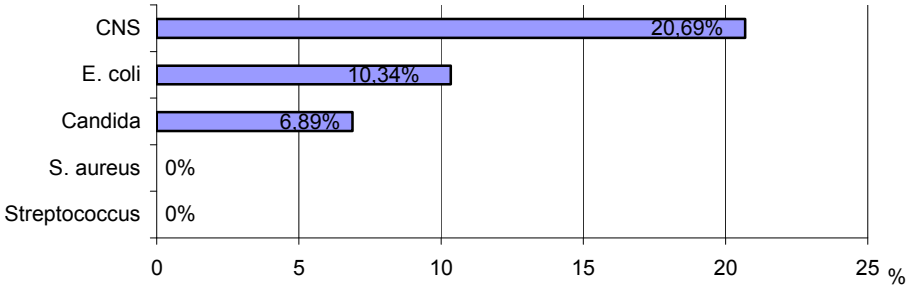

Fig. 4. Percentage (%) of microbes recovered from collected swabs
Ryc. 4. Odsetek (%) wyizolowanych mikroorganizmów z pobranych wymazów

High levels of bacterial and fungal aerosol have a negative impact on the immune mechanisms of animals and workers, its operation is strengthened by dust particulates or gaseous air components. *Cladosporium species* was shown to trigger 67% of allergic reactions to fungi, it was also recovered during the present research on the fox farm. People sensitive to these allergens may have severe visible allergic response. Particularly in inadequately ventilated premises, the microclimatic parameters are disturbed which promotes growth and development of the bioaerosol [Dutkiewicz and Górny 2002, Mędrela-Kuder 2005, Węsierska 2006].

With the aim of accurate determination of farm microbial contamination and exposure of farm workers as well as possible microorganism long-distance spread in the wind, there should be performed monitoring of bacterial and fungal air bioaerosol. Monitoring the animals and farm workers exposure to hazardous environmental agents should be employed to better cope with them. Whereas, differentiation of indoor microflora species ought to constitute an indicator of the sanitary-hygiene status.

CONCLUSIONS

1. Air microbial contamination and farm buildings under study is insignificant.
2. The sanitary conditions maintained do not pose any health risk for animals and farm workers

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Streszczenie. Badania aerozolu biologicznego prowadzone w fermie lisów polarnych wykazały średnią koncentrację bakterii mezofilnych w powietrzu na poziomie $5{,}13 \times 10^2$ CFU/m^3, ogólna zaś liczba bakterii wynosiła $4{,}22 \times 10^4$ CFU/m^3, co świadczyło o nieznacznym zanieczyszczeniu powietrza. Wśród oznaczonych drobnoustrojów stwierdzono obecność: gronkowców koagulazo-ujemnych (CNS), pałeczek Gram-ujemnych, ziarniaków, bakterii z rodzaju *Proteus*, *Corynebacteriaceae* oraz grzybów pleśniowych z rodzaju *Mucor, Cladosporium, Aspergillus* oraz *Penicillium* i *Ulocladium*. W materiale pozyskanym z wymazów od zwierząt oraz ich środowiska wykazano największy udział CNS (20,69%). Nie stwierdzono obecności gronkowca złocistego i paciorkowców.

Słowa kluczowe: bioaerosol, powietrze, ferma lisów