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Effect of galliform birds on microbial pollution of soil and water in a chosen agro-tourist farm

Wpływ drobiu grzebiącego na zanieczyszczenie bakteriologiczne gleby i wody w wybranym gospodarstwie agroturystycznym na Lubelszczyźnie

Summary. The objective of the present study was to determine the effect of galliform birds on the microbial pollution of soil and water in a chosen agro-tourist farm, where the median samples of bird litter, soil and water from a pond were collected. The bacteriological qualitative and quantitative evaluation was performed of the samples in the laboratory in compliance with the obligatory norms. The analysis included coli titres, total count of mesophilic and psychrophilic bacteria, bacteria from coli group, proteolytic, actinomycetes, etc. Besides, the basic macro- and microclimatic parameters were established.

Key words: agro-tourist farm, sanitary-hygienic conditions, microbial pollution

INTRODUCTION

In Poland, the recent years have been marked with the growing interest in agro-tourist farm development, which is associated with two factors. One factor concerns people who run such farms and the other with increasing concern for the natural values of the farms. However, it should be born in mind, that providing agritourism services imposes some changes in the production structure, immediate vicinity of the house and in farm itself [Tabor 1998]. Agritourism activity may become a significant source of income in a farm [Dach *et al*. 2000, Maciejewska 2003]. Richness of animal species in the agritourist farms affects the sanitary-hygienic conditions of the area and implicates emission of harmful air pollutants or mineral accumulation in soil [Rachwał 2000]. Therefore, the farm holders are expected to maintain animals in good body condition to preserve appropriate environmental qualities of the region. It is well known that a good state of animal health reduces the incidence rate of human and animal diseases [Brodziak

1997, Sadowski 2000, Wasyl *et al*. 1999]. Animals are proven to play a key role in the spread of infections, in the case of poultry *Salmonella*-induced infections are most common [Mazanowski 1988, Świerczewska and Siennicka 2004, Wasyl *et al*., 1999]. Animal body condition is directly related with the health of agri-tourist farm visitors. Importantly, a welfare level characterizing the animals maintained in the agri-tourist farm is far higher as compared to the conventional ones [Sammel and Dańczak 2002].

MATERIAL AND METHODS

The research material was constituted by the samples of litter and water from the nearby pond and soil, all collected from the agri-tourist farm situated in the Lublin Province. The litter was sampled from the building which housed various species of galliform birds (hens, guinea-hens, quails, turkeys, peacocks). In the close neighborhood to the poultry facility, there is the outdoor run for African ostrichs. The median samples were taken in the immediate vicinity of the building entrance, in half length of the building and close to the wall furthest of the entrance (P1, P2, P3, respectively). Soil was sampled close to the external wall of the facility, then 5 and 10 m away (G1, G2, G3, respectively). Pond water samples were collected at pond bank, in ¼ of its diameter length and in the pond centre (W1, W2, W3, respectively). The water reservoir harbored fen-ducks and various species of tortoises, being a shelter for migrating waterfowl as well. There were also performed the indoor and outdoor measurements of the macro- and microclimatic parameters (temperature, relative air humidity, air movement and cooling). Besides, the physical properties of pond water were examined (temperature, pH, color, flavor and turbidity). Litter and soil moisture was evaluated in the laboratory. The collected samples were examined for mesophilic and psychrophilic bacteria, bacteria from coli group, proteolytic, actinomycetes etc. The samples were delivered to the laboratory and evaluated bacteriologically in compliance with the obligatory norms [PN-ISO 9308-1, PN-Z-19000-1].

RESULTS AND DISCUSSION

Analysis of the bacteriological studies of the litter (Tab. 1) showed the highest count of mesophilic bacteria in the sample P1 (8.25×10^7), while the lowest in P3 (9.0×10^5). The highest numbers of psychrophilic bacteria was observed in the sample P1 (3.85×10^8) and the lowest in P3 (3.30×10^6). As for the litter, the presence of thermotolerant bacteria was detected in the sample P1, *Escherichia coli* in all the samples taken, while *Klebsiella* and *Shigella* bacteria in the sample P1 and P3. The highest proteolytic bacteria count was recorded in the sample P1 (9.0×10^7).

Assessment of the microbiological analysis results of soil (Tab. 2) revealed the highest numbers of mesophilic bacteria in the sample G1 (3.65×10^6), while the lowest in the sample G3 (7.50×10^5). The highest psychrophilic bacteria count was determined in the sample G3 (1.70×10^5). The lowest coli titre (0.001) was noted in the sample G1, the only sample that harbored coli bacteria group. Klebsiella bacteria were recorded in the sample G1 and G2. The highest count of proteolytic bacteria was detected in the sample G1 (2.10×10^7) and actinomycetes in G1 (4.0×10^6).

Table 1. Quantitative and qualitative bacteriological analysis of litter
Tabela 1. Ilościowa i jakościowa analiza bakteriologiczna pomiotu

Bacteria genus Rodzaj bakterii	P1	P2	P3
Mesophilic Mezofilne	8.25×10^7	6.19×10^7	9.0×10^5
Psychrophilic Psychrofilne	3.85×10^8	2.06×10^7	3.30×10^6
From coli group Z grupy coli	0	0	0
Thermotolerant coli Coli termotolerancyjne	2.20×10^6	0	0
Others Inne	*Escherichia coli* *Shigella, Klebsiella*	*Escherichia coli*	*Escherichia coli* *Shigella, Klebsiella*
Proteolytic Proteolityczne	9.0×10^7	6.0×10^6	1.0×10^6

P1 – litter collected at poultry facility entrance – pomiot pobrany przy wejściu do budynku
P2 – litter collected in facility half length – pomiot pobrany w połowie budynku
P3 – litter collected at the end of facility – pomiot pobrany na końcu budynku

Table 2. Quantitative and qualitative bacteriological analysis of soil
Tabela 2. Ilościowa i jakościowa analiza bakteriologiczna gleby

Bacteria genus Rodzaj bakterii	G1	G2	G3
Mesophilic Mezofilne	3.65×10^6	2.20×10^6	7.50×10^5
Psychrophilic Psychrofilne	1.43×10^6	1.30×10^6	1.70×10^5
Coli titre Miano coli	0.001	> 0.01	> 0.01
From coli group Z grupy coli	3.10×10^5	0	0
Thermotolerant coli Coli termotolerancyjne	0	0	0
Others Inne	*Escherichia coli* *Klebsiella*	*Klebsiella*	0
Proteolytic Proteolityczne	2.10×10^7	5.50×10^6	1.0×10^5
Actinomycetes Promieniowce	4.0×10^6	4.0×10^6	3.0×10^5

G1 – soil collected at poultry facility entrance – gleba pobrana przy ścianie budynku
G2 – soil collected 5 m of the facility – gleba pobrana 5 m od budynku
G3 – soil collected 10 m of the facility – gleba pobrana 10 m od budynku

Table 3. Quantitative and qualitative bacteriological analysis of pond water
Tabela 3. Ilościowa i jakościowa analiza bakteriologiczna wody pochodzącej ze stawu

Bacteria genus Rodzaj bakterii	W1	W2	W3
Mesophilic Mezofilne	3.05×10^2	4.40×10^2	4.0×10^2
Psychrophilic Psychrofilne	7.0×10^2	8.90×10^3	3.50×10^2
From coli group Z grupy coli	3.0×10^1	3.0×10^1	2.0×10^1
Thermotolerant coli Coli termotolerancyjne	3.0×10^1	4.0×10^1	4.0×10^1
Others Inne	*Escherichia coli* *Salmonella* spp.	*Escherichia coli* *Salmonella* spp.	*Escherichia coli* *Salmonella* spp.
Proteolytic Proteolityczne	1.9×10^1	4.0×10^1	9.0×10^1

W1 – water collected at the pond bank – woda pobrana przy brzegu stawu
W2 – water collected in ¼ pond length – woda pobrana w ¼ długości stawu
W3 – water collected in ½ pond length – woda pobrana w ½ długości stawu

Table 4. Evaluation of chosen physicochemical parameters of pond water and air humidity and temperature in the pond region
Tabela 4. Ocena wybranych parametrów fizykochemicznych wody ze stawu oraz wilgotności i temperatury powietrza w jego okolicach

Parameter Parametr	W1	W2	W3
Temperature Temperatura (^{o}C)	21.00	20.00	20.00
pH pH	8.14	8.13	8.23
Color Barwa (TCU)	10	10	10
Turbidity Mętność (mg/l)	2.94	1.76	1.76
Air temperature Temperatura powietrza (^{o}C)	25.30	26.20	25.20
Air humidity Wilgotność powietrza (%)	58.00	47.00	51.00

W1 – water collected at pond bank – woda pobrana przy brzegu stawu
W2 – water collected in 1/4 pond length – woda pobrana w ¼ długości stawu
W3 – water collected in ½ pond length – woda pobrana w ½ długości stawu

Wastes of farming animals present a serious threat to the biological balance in the environment and this fact has been supported by both, quantitative and qualitative bacteriological evaluation of the soil samples. Plants contaminated with animal waste become

a source of infection of animal and human [Kamińska *et al*. 1993]. Implementation of proper managemental and preventive measures may reduce the likehood of microbiological infection incidence [Mazanowski 1993].

Bacteriological study of pond water (Tab. 3) showed the highest count of mesophilic and psychrophilic bacteria in the sample W2 (4.40×10^2, 8.90×10^3). In all the water samples collected, the presence of bacteria from coli group and *Salmonella* spp. was detected. The highest numbers of proteolytic bacteria was observed in the sample W3 (9.0×10^1). The examination of the chosen parameters of pond water (Tab. 4) revealed that in all the samples collected, both pH and water temperature maintained at the similar level.

CONCLUSIONS

1. In the agro-tourist farm under study, galliform birds presented a source of bacteria contaminating litter and soil, however median count of bacteria decreased with increased distance from the poultry facility.

2. Salmonella bacteria occurrence in the analyzed pond water was likely to result from the presence of wild waterfowl.

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Streszczenie. Celem pracy było określenie wpływu drobiu grzebiącego na zanieczyszczenie bakteriologiczne gleby i wody w wybranym gospodarstwie agroturystycznym. W gospodarstwie pobrano uśrednione próbki pomiotu ptasiego, gleby oraz wody ze stawu. W laboratorium dokonano bakteriologicznej analizy jakościowej i ilościowej powyższych próbek zgodnie z obowiązującymi normami. Analiza obejmowała badania miana coli, ogólnej liczby bakterii mezofilnych i psychrofilnych, bakterii z grupy coli, proteolitycznych, promieniowców i in. Dodatkowo określono podstawowe parametry charakteryzujące warunki makro- i mikroklimatyczne.

Słowa kluczowe: gospodarstwo agroturystyczne, warunki sanitarno-higieniczne, zanieczyszczenie bakteriologiczne