FARM WATER AS A POSSIBLE SOURCE OF FUNGAL INFECTIONS

ABSTRACT: The quality of drinking water depends on the water sources, but also on the quality of the water distribution system which supplies the water on to the final user. In addition, the possibility of contamination of water used for watering animals in the farm buildings depends on the hygienic conditions on farms. Microbiological quality of water on farms in Serbia has not been one of the main focuses of animal breeders, although according to the Food Safety Law water is considered as food. As feed safety for the animals, which includes microbiological analyses, is an important concern of breeder farmers, it is also important to control the water safety in order not to become a cause of the animal health problems. Change of the water quality is not important only from the sanitary epidemiological point of view, but the presence of different microorganisms, especially fungi, can cause changes in taste and smell, as organoleptic properties of water. According to legal regulations, there is no difference between the quality requirements for drinking water relative to the water supply intended for animals. For the aforementioned reasons, the subject of this study is microbiological control of water samples from the drinkers for animals at farms. The aim of the work is to examine which fungi are possibly present in the water and what their number is. In total, 35 samples of water from pig and poultry farms were tested. The method of direct seeding and filtration was used. The presence of different types of mold (Aspergillus sp., Penicillium sp., Alternaria sp., Mucor sp. and Rhizopus sp., and Candida sp.) was determined. The results indicate the necessity of microbiological control of water for watering of farm animals, which implies the analysis for the presence of molds.

KEYWORDS: water for watering animals, molds

INTRODUCTION

The normal functioning of the physiological activities of the living world depends on the presence of nutrients and water. In order to provide the production features of domestic animals, it is important to ensure quality and healthy food and water for feeding animals. According to the Food Safety Law (Official...
water is considered as a foodstuff and must be healthy and safe as much as all the other nutritive substances that are used for human consumption. In accordance with these legal requirements there is no difference in the quality of water used for the watering of animals in relation to drinking water intended for humans. The Regulation on Hygienic quality of drinking water (Official Gazette, 1999) defines limit values of microbiological quality of drinking water. These limits vary depending on the sources used for water supply. In the given lists of microbiological characteristics of drinking water, regardless of whether it is purified, disinfected or bottled water, or the natural waters from closed and opened water sources, they must not contain, in addition to listed bacteria and algae, any other organisms that can alter the appearance of smell and the taste of water. The regulations do not explicitly mention the necessity to control the presence of fungi (molds and yeasts) in water but, without doubt, their presence may potentially affect water quality and thus the health of the animals and the people consuming it.

Supply of farm animals with water has its own characteristics with different aspects. Besides the local rural or suburban water supply system, for supplying water to the farms dug wells within the same farm can be used. Except the aforementioned facts, a part of an aqueduct, located within a farm, can be used for antibiotic treatment of animals when needed. Medicators (Stojanov et al. 2003) are part of the water supply system ensuring that the application of antibiotic therapy, carried out for a sufficient period of time with the required concentration of the drug, will provide a therapeutic dose and efficacy of the administered antibiotics. The potential risk of the creation and expansion of biofilms (Wingender and Flemming, 2011), as well as the specifics of the water system on farms, provide a good opportunity for the survival and spread of the fungi. A research on the presence of fungi in drinking water (Hageskal et al. 2009) in the past decade, indicates that they are water contaminants. It also indicates that our knowledge of their presence in water and their importance for health have not been sufficiently explored. The finding of fungi in water, including filamentous molds and yeasts, may not have a direct effect on the health. Indirectly, molds could be potentially pathogenic, toxic or allergenic biological agents that harm the health, particularly in immuno-compromised individuals (Hageskal et al. 2009). Finding fungi in hospital, in aerosols from the shower or tap water, and saunas, allows for the possibility that the infection spread through inhalation. Similar situation is possible on farms.

The hygienic conditions in facilities where animals are bred are far disadvantageous, compared to those in hospitals. For these reasons, the subject of our study is microbiological control of water samples from the drinkers for farm animals. The aim of this paper is to examine which fungi are possibly present in water and what their number is.

MATERIAL AND METHODS

Water samples processed in the laboratory came as part of regular analysis of the water for watering of farm animals. A total of 23 water samples from
poultry farms and 12 samples from a pig farm were examined. The samples were taken from the drinker in the facilities of a farm. Before the samples were collected in sterile bottles, water from the drinkers is poured out 3 times. In that way, the negative impact of possible contamination of water with residual food that animals can leave during watering was reduced. The taken samples were transferred to the laboratory at 4 ºC for 2–4 hours. The samples were divided in two parts. The first part was directly inoculated on a nutrient substrate, while the other part was filtered off, after which the filter was seeded into a nutrient medium. The laboratory methods described in the national laws for samples examination (similar with international methods) are obligatory. Direct seed included microbiological testing according to the Regulation on the method of sampling and laboratory methods for the analysis of drinking water (Official Gazette, 1987), and it was added to Sabouraud agar (Biocare) for isolation of fungi. Water was filtered by the Millipore filters and disposable cups (MF – MilliporeTM, Microfila Funnel & Filter, 250ml, 0,45μm 47mm) and single-channel filtration system (Millipore), after which the filter was seeded directly into Saburo agar. The seeded plates were incubated at 25 ºC for 4 days.

RESULTS AND DISCUSSION

The microbiological control of drinking water includes the control of the presence of bacteria, viruses or parasites, which can contaminate water and affect human health (Hageskal et al. 2009). The problem of control of water used for watering animals in this country is relatively neglected because breeders do not realize the importance of microbiological safety of water used by farm animals. It seems that they are not aware that water is also foodstuff and that it has to be controlled as any other food (Stojanov et al. 2015). Table 1 presents the results of microbiological analysis of water. The samples were directly planted on nutrient medium.

<table>
<thead>
<tr>
<th>Samples from facility</th>
<th>No. of processed samples</th>
<th>No. of samples that did not correspond to the regulations on the hygienic quality of drinking water</th>
<th>No. of samples positive for the presence of fungi</th>
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<tr>
<td>Samples from poultry facility</td>
<td>23</td>
<td>21</td>
<td>5</td>
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<tr>
<td>Samples from pig facility</td>
<td>12</td>
<td>10</td>
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Isolated fungal species from water samples: *Aspergillus* spp., *Penicillium* spp., *Alternaria* spp., *Rhizopus* spp., *Mucor* sp. and *Candida* sp.

Fungi are divided into several groups according to their systematization. They belong to kingdom *Eumycota* and are classified into the five phyla: *Ascomycota*, *Basidiomycota*, *Zygomycota*, *Chytridiomycota*, and *Glomeromycota*
(Kirk et al. 2001; Schüßler et al. 2001). According to the structure, fungi can be divided into filaments which are called molds, yeasts and mushrooms. Some fungi are naturally adapted to water and therefore can be found in it as normal inhabitants. They are called zoosporic fungi and mainly belong to the phylum Chytridiomycota. The fungi which belong to other phyla of Eumycota are adapted to the terrestrial conditions and can be found in soil, organic matter and air (Kirk et al. 2001). These types of fungi can enter water from the above mentioned substrates, so it can be said that water is not their natural environment. The water analyzed in this paper, certainly, could be contaminated with different types of fungi, because it was taken from the building where animals lived and where there was a large amount of organic matter. With regard to this, it is important to emphasize that the level of humidity in farm facilities is usually very high, which makes favorable conditions for fungi. In this study, it was found that a large number of water samples used for watering animals was microbiologically incorrect. Most commonly present were coliforms and fecal coliforms, as well as fecal streptococci. Unfortunately, there could not be determined the correlation with the finding of fungi. Similar results were reported by Pereira et al. (2009) when testing three different samples of drinking water.

In Table 2 are given data on tested samples with the filtration. In this test was used 100 mL water sample. Samples were filtered through a 0.45μm filter. The filter was seeded into the surface of a nutrient agar.

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<td>Samples from poultry facility</td>
<td>23</td>
<td>23</td>
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<tr>
<td>Samples from pig facility</td>
<td>12</td>
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Comparing the results in Table 1 and Table 2, it can be seen that the method of filtration was better than method of direct plating. We found that every water sample from a facility where animals are bred was not in accordance to the criteria of the regulations on hygienic quality of drinking water. This result was expected. However, the method of filtration could not be used to determine the total number of mesophilic bacteria. Due to the large presence of bacteria in the water, determining the total number of bacteria is not possible by the method of filtration. A large number of bacteria which were retained by the filter after the inoculation did not allow determination of the total number of microorganisms.

All kinds of isolated fungi in the tested water samples do not represent the pathogens that would directly jeopardize the health of animals. Similar results
were reported by Goncalves et al. (2006) who examined the drinking water in buildings where people live. Some of the isolated fungi can be potentially pathogenic, can represent allergens or possess toxigenic potential. Certain species of Aspergillus were present in 49% of samples tested at the University Hospital in Norway (Warris et al. 2009). However, Aspergillus fumigatus was one of the most common pathogens that caused infections in immunocompromised individuals (Marr et al. 2002; White, 2005). Hospitals are facing significant increase in opportunistic infections caused by fungi in patients with reduced functional status of the immune system (Denning, 2006). The use of corticosteroids, chronic diseases, diabetes, HIV infection, and surgical interventions can be some of the predisposing factors that create a favorable conditions for fungal infections. Particular issues are the aging of human population and the increasing number of transplantations and human cancers (Perlroth et al. 2007).

A special aspect of the issue of the presence of different microorganisms in drinking water is the possibility of the formation of biofilms. Finding biofilms in water supply system can represent temporary or permanent problem. It mainly depends on the species of microorganism found there, as well as on the hygiene standards (Wingender and Flemming, 2011). All the uncertainties and potential risks related to the water system and drinking water in the human population, when compared to water quality and water supply systems within farm, indicate the need for water control and continuous monitoring of the farm water quality.

CONCLUSION

Our testing included microbiological control of water for watering on pig and poultry farms. In the tested samples, the presence of fungi and bacteria was determined. The presence of fungi in the samples was between 20% and 40% and it was dependent on the method used. The filtration method was better for testing water for the presence of fungi, while the direct seeding method proved to be better for determining the presence of bacteria.

The finding of fungi in the tested samples indicates a possible microbiological disadvantage of the water. In addition, these microorganisms change organoleptic properties because they change the smell and taste of water. Studies indicate the need for microbiological control of water, which includes bacteriological and mycological examination.

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ВОДА СА ФАРМИ КАО МОГУЋИ ИЗВОР ИНФЕКЦИЈА ГЉИВИЦАМА

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РЕЗИМЕ: Квалитет воде за пиће зависи непосредно од самог изворишта која се користи за добијање воде, а посредно од квалитета дистрибутивног система којим се вода транспортује до корисника. Вода која служи за напајање животиња у објектима додатно је оптерећена могућностима контаминације различитим микроорганизмима, укључујући и гљивице, што је условљено хигијенским околностима фарме. Макробиолошка исправност воде на фармама, у нашем условима, најчешће није предмет пажње одгајивача животиња иако се према Закону о безбедности хране вода сматра намирницом. Онако како се одгајивачи — фармери брину о здравственој исправности хране, што обухвата микробиолошке и нутритивне анализе квалитета хране, тако је важно да се и вода контролише како не би постала разлог здравствених проблема животиња. Промена квалитета воде није важна само са епидемиолошког санитарног аспекта, већ присуство различитих микроорганизама, а посебно, гљивица може довести до промене укуса и мириса што мења органолептичка својства воде. Према наведеним законским одредбама не постоји разлика у квалитету вода које се користе за употребу напајања животиња у односу на воду за пиће намене за људе. Специфични хигијенски услови у објектима, бунари на фармама који се користе као изворишта напајања животиња и могућност коришћења водоводног система фарме за терапирање оболелих животиња су неке од критичних тачака у сточарској производњи који представљају разлог микробиолошке контроле воде. Из наведених разлога предмет нашем раду је микробиолошка контрола узорака воде из појилица с којих се животиње напајају водом на фарми. Циљ рада је да утврдимо да ли се у испитаним узорцима налазе гљивице и колика је њихова заступљеност. Укупно је прегледано 35 узорака воде са фармама свиња и животиња. Коришћен је метод директног засејавања и филтрације. Утврђено је присуство различитих врста плесни (Aspergillus, Penicillum, Alternaria, Mucor, Rizopus и Candida). Резултати указују на неопходност микробиолошке контроле воде за напајање животиња која обухвата и анализе присуства плесни.

КЉУЧНЕ РЕЧИ: вода за напајање животиња, плесни