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OCCUPATIONAL EXPOSURE TO AIRBORNE MICRO-ORGANISMS AND ENDOTOXINS

IN FOUR ALTERNATIVE HOUSING SYSTEMS FOR LAYING HENS


floor keeping system with integrated litter space


floor keeping system with outdoor access


aviary with integrated litter space


furnished cage system

Introduction

With the move to alternative housing systems for laying hens in the EU (1999/74/EC), in order to improve animal welfare, new systems have been introduced which allow the birds more free movement than in the former battery cages. However, little is known about the air pollution in these systems.

Airborne micro-organisms and endotoxins were measured in a floor keeping system with integrated litter space, a floor keeping system with outdoor access, an aviary with integrated litter space and a furnished cage system in oder to assess the burden of the respiratory tract of employees working in these systems. Samples were taken monthly from June 2007 to May 2008 by Impingement (AGI 30) 150 cm above the floor in the center of the barns.

Results

Endotoxin concentrations show high variations between the housing types and seasons (Fig. 1). Lowest concentration is found in the air of the furnished cage system, highest in the floor keeping system with integrated litter space with a maximum in winter. An analogue trend is apparent for the number of mesophilic bacteria (Fig. 2): the highest number of CFU/m³ is found in the floor keeping system with an increase in the winter months. Very similar results are presented for airborne staphylococci (Fig. 3).Their concentrations reach nearly the same values, especially in the floor keeping system with integrated litter space, whereas the share of staphylococci of total bacteria in the system with outdoor access is only up to about 70%.

Endotoxins

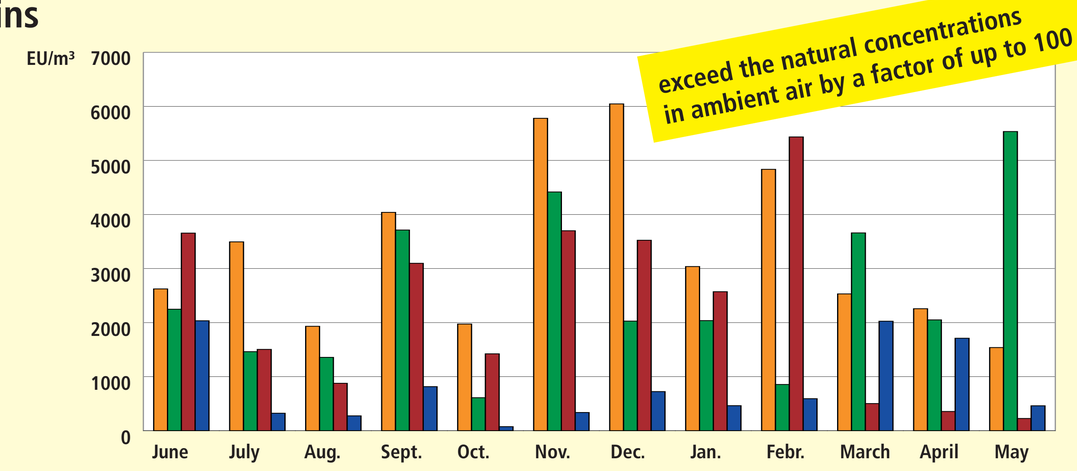

Fig. 1: Airborne endotoxins (endotoxin units, EU) found per m³ in the four different housing systems. n=3 for each column.

Mesophilic aerobic bacteria

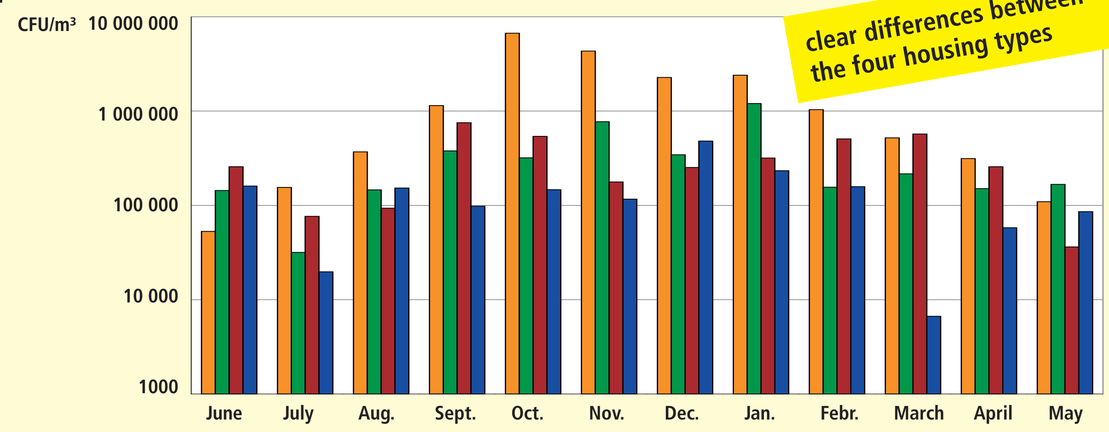

Fig. 2: Number of CFU of airborne mesophilic aerobic cultivable bacteria found per m³ in the four different housing systems. n = 18 for each column.

Staphylococci

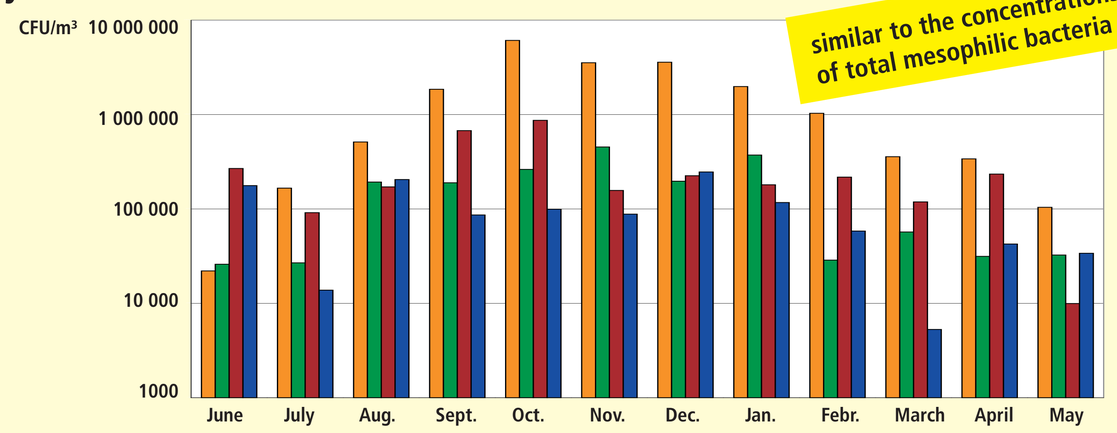

Fig. 3: Number of CFU of airborne staphylococci found per m³ in the four different housing systems. n = 18 for each column.

Discussion

The visible seasonal differences between concentrations of airborne bacteria and endotoxins are predominantly caused by different ventilation rates in winter and summer. In winter the ventilation rate is reduced, resulting in higher concentrations of micro-organisms. The main share of total mesophilic bacteria is held by the fraction of staphylococci except for the system with outdoor access where the entry of ambient bacteria may account for a more variable spectrum of bacteria. The use of litter seems to have an additional effect as both systems with integrated litter space show the highest numbers of airborne bacteria. Another factor could be the regular removal of faeces by a manure belt (aviary and furnished cage system), whereas in systems with manure pit the faeces are stored inside the housing for the whole laying period and may contribute to the burden of airborne micro-organisms and endotoxins.

Conclusion

Endotoxin respectively bacteria concentrations in the air of alternative housing systems for laying hens exceed the natural concentrations in ambient air by a factor of up to 100 respectively 10 000. There is a strong influence of housing type and season on endotoxin and bacterial counts.
The results indicate an urgent need to protect farm workers in alternative laying hen houses from these compounds e.g. by breathing masks in order to prevent negative health effects.

- improve air quality in alternative laying hen houses
- protect work force by breathing masks

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