

ASSESSMENT OF MICROBIAL POLLUTANTS INSIDE LIVESTOCK SHEDS IN AN ORGANISED FARM

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ABSTRACT

Intensive livestock production is a significant source of microbial air contamination which affects human and animal health. The present study was conducted to assess microbial pollutants inside livestock sheds in an organised farm. Air samples inside dairy, pig fattener sty and farrowing pens were collected using air sampler to identify Total Bacterial count, Mould count and Coliform count. Total Bacterial Count (CFU/m³) was found to be minimum in dairy sheds during summer (152.49±12.92) and maximum in farrowing pen during rainy season (382.33±38.83). Mould count (CFU/m³) ranged between 48.75±7.78 and 235.00±20.73 between seasons in livestock sheds. Coliform count (CFU/m³) was minimum in dairy shed during rainy seasons (11.25±5.09) and maximum in winter seasons in farrowing pens (31.25±7.96). Bacterial isolates such as Staphylococcus epidermidis, Salmonella, Edwardsiella sp, Flavobacterium sp, Micrococcus sp, Pasteurella sp, Mannheimia sp, E.coli, Klebsiella sp, Bordetella sp, Enterobacter sp, Aeromonas sp, Bacillus sp, Proteus sp, Actinomyces sp, Corynebacterium sp, Pseudomonas sp from the floor of livestock sheds were isolated and identified.

Key words: Air Sample, Livestock sheds, Total Bacterial count, Mould count, Coliform count

INTRODUCTION

In recent decades, intensive livestock production has become more common in India. Intensive livestock production that deals with large density of animals in small area is a significant source of microbial air contamination that may constitute a considerable risk to human and animal health. The presence of micro-organisms in livestock shed contaminates the products which are likely to reduce their shelf-life. A base line data on airborne microbial pollution levels in dairy (ruminants) and pig (monogastric) housings are scanty in our country. Based on the above facts

in view, the present study has been carried out to assess the microbial pollutants inside the livestock sheds.

MATERIALS AND METHODS

The experiment was carried out at TANUVAS University Research Farm, Madhavaram milk colony, Chennai- 51. The experiment was conducted from August 2014 to April 2015. The experiment period comprised rainy (August – December), winter (January– February) and summer (March – April) seasons. The dairy shed which housed cross bred dairy

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cows, farrowing pen with four farrowing crates and pig fattener sty housing pigs from weaning till market age were selected as the experimental sheds. The buildings were located in east – west orientation.

Estimation of air pollution in livestock sheds

Air samples were collected biweekly inside the livestock sheds using Hi-Media air sampler (model: LA002) (Desai et al., 2012 and Chakrabarty et al., 2014). The sampler was held 1m above the ground at head level of animal and collected for 5 minutes. The impeller speed of 4000 rpm was so adjusted that 280 litres of air was collected every minute. The sampling volume corresponds to 40 litres/minute of separation volume; i.e. 1/7 of the sampling volume. The microbial air sampler was operated at an air flow-rate of 280 l/min. The microbial air contamination was measured by counting the number of bacterial colonies in the strip and estimated in Colony Forming Unit per cubic meter of air (CFU/ m³).

$$\text{CFU / m}^3 = \frac{\text{Number of colonies on agar strips} \times 25}{\text{Sampling time in minutes}}$$

Bacterial isolation from floor of livestock sheds: Floor swabs were collected aseptically from three different places (feeding area, standing area and defecating area), and pour plate method was carried out to obtain individual bacterial colonies for isolation (Gibson, 1999). The colonies were streaked on different selective media (Mannitol salt agar, Blood agar, MacConkey agar, Brilliant green agar and Ceitrimide agar). The pure cultures were subjected to biochemical tests using assorted kit (Hi-Media). Individual kits were used separately for bacterial isolation for which a pure culture of the bacterial colony was streaked on the kit and kept for overnight incubation at 37°C. Bacterial identification was done based on the colour change in the individual kit. The data collected were subjected to statistical analysis as per the method of Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The fortnightly mean \pm S.E of total bacterial count, mould count and coliform count (CFU /m³) in livestock sheds during different seasons are presented in Table 1. It was found that the total bacterial count was minimum in dairy shed during summer (152.49 \pm 12.92) and maximum in farrowing pen during rainy season (382.33 \pm 38.83). The total bacterial count was significantly different (P<0.01) between seasons in dairy and fattener pig sty and during rainy season in all the sheds. The seasonal variation in microbial load was reported by earlier workers in animal sheds (Andersson et al., 1999; Jo et al., 2005 and Gautam et al., 2011). In the present study total bacterial count was minimum during summer, compared to other seasons which is in agreement with the findings of Duchaine et al. (2000). Dutkiewicz et al. (1994) and Popescu et al. (2011) reported a higher value of microbial load in animal house than the present findings, whereas Adhikari et al. (2004) and Dungan et al. (2011) reported almost similar trend in microbial load in their reports.

The mould count was ranged between 48.75 \pm 7.78 and 235.00 \pm 20.73 which is in agreement with the findings of Dungan et al. (2011), but much lower than that reported by Matkovic et al. (2007). High summer temperature and relative humidity could enhance fungal growth inside animal sheds with lower ventilation rates (Jo et al., 2005). But in present study the mould count was found to be minimum in all the livestock sheds which might be due to good ventilation. Duchaine et al. (2000) in their study observed that the mould count and type were not influenced by seasons.

Coliform count (CFU/m³) was minimum in dairy shed during rainy season (11.25 \pm 5.09) and maximum in winter season in farrowing pen (31.25 \pm 7.96). The coliform count in the present study agrees well with the findings of Chinivasagam and Blackall (2005). The statistical analysis showed no difference in coliform count

between sheds and seasons in the present study, which is in contrast with the report of Gautam et al., (2011), where seasonal variation on E.coli was reported. The successful survival of airborne bacteria depends on factors such as temperature, relative humidity, oxygen concentration and sunlight exposure. High relative humidity (70-90%) and ultra violet light have lethal effect towards bacteria and aerosol dissemination of strata bacteria into different strata of atmosphere can also affect the survival characteristics of the organism. Atmospheric turbulence, influenced by local atmospheric conditions and diurnal variation in solar radiance reaching the ground influences survival. Ventilation system has a significant effect on the indoor levels on airborne fungi (Tang, 2009). Twenty two pure bacterial colonies were isolated up to Genus level among thirty samples processed. The bacteria isolated from the floor of livestock sheds were *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Staphylococcus sp*, *Salmonella*, *Edwardsiella sp*, *Flavobacterium sp*, *Micrococcus sp*, *Pasteurella sp*, *Mannheimia sp*, *E.coli*, *Klebsiella sp*, *Bordetella sp*, *Enterobacter sp*, *Aeromonas sp*, *Bacillus sp*, *Proteus sp*, *Actinomyces sp*, *Corynebacterium sp*, *Pseudomonas sp*. Duchaine et al., (2000) and Matkovic et al., (2007) have isolated different bacterial species inside livestock sheds in their studies.

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Table 1

The fortnightly mean \pm S.E and analysis of variance of Total Bacterial count, Mould count and Coliform count (CFU/m³) in livestock sheds

	Treatment	Dairy shed	Pig fattener sty	Farrowing pen
Rainy	Total bacterial count	190.75 ^{Abc} \pm 11.74	227.14 ^{Ab} \pm 21.14	382.33 ^{Aa} \pm 38.83
	Mould count	151.25 ^A \pm 14.96	197.50 ^A \pm 23.41	193.75 ^A \pm 22.07
	Coliform count	11.25 \pm 5.09	22.50 \pm 6.92	26.25 \pm 7.08
Winter	Total bacterial count	219.77 ^{Abc} \pm 19.18	235.69 ^{Ab} \pm 14.68	307.61 ^{Aa} \pm 27.52
	Mould count	157.50 ^{Abc} \pm 12.94	163.75 ^{Ab} \pm 12.00	235.00 ^{Aa} \pm 20.73
	Coliform count	13.75 \pm 6.31	20.00 \pm 5.65	31.25 \pm 7.96
Summer	Total bacterial count	152.49 ^{ABbc} \pm 12.92	165.28 ^{ABb} \pm 13.00	265.28 ^{ABa} \pm 20.70
	Mould count	48.75 ^B \pm 7.78	81.25 ^B \pm 11.22	85.00 ^B \pm 14.29
	Coliform count	12.50 \pm 6.45	12.50 \pm 4.93	28.75 \pm 8.75

Means bearing different superscript in the same row and column differ significantly
Capital letter indicates for column and small letter indicates for row.