Design and Application of an Affordable Air Sampler for the Detection of Bacterial Aerosols in Poultry Farms

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Bacterial pathogens can be spread through the air in poultry farms, threatening poultry farmers and flocks alike. Current air sampling methods are expensive and unaffordable for many farmers. Little is known about aerosolized bacterial populations in different poultry operations. This project aims to develop and apply an affordable and effective air sampler to study population diversity of aerosolized bacteria in broiler and layer operations. A new sampler was designed with a vacuum pump to draw air onto a gelatin membrane filter and validated to effectively collect aerosolized bacteria in both lab and field settings. The sampler was applied in poultry houses with clean litter (control), litter from broiler chickens, and litter from layer chickens. Quantification using bacterial culture showed that bacteria from layer litter was the most abundant whereas the control had the least. The bacteria were primarily Staphylococcus and Bacillus with little variation among the groups. E. coli and Salmonella-specific quantitative PCR (qPCR) showed that the number of E. coli was statistically different between the control group and either broilers or layers but not between broilers and layers; no Salmonella was detected. For population analyses, MiSeq was used to determine 16s ribosome DNA profiles. 1,212 bacteria species were found, and the results were consistent with those in bacteria culture and qPCR. Among 775,656 reads, Staphylococcus was the most abundant (13.68%); Bacillus and E. coli had 16,703 and 3,566 reads, respectively, but only 1 read of Salmonella was found. In summary, an affordable air sampler was designed, and the application of the sampler revealed that broiler and layer operations affect the number of aerosolized bacteria but not the species present.