

## Air-borne bacterial contaminations in two broiler hatcheries in the North-East of Algeria

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### Abstract

The presence of microorganisms in the hatchery is directly related to deficiencies in hygiene which can result in elevated first-week chick mortality and depressed growth rate. Bacteriological analyses of the air in two broiler hatcheries in the province of Constantine (North-East of Algeria) showed that their hygienic levels remain insufficient with high contamination rates and the presence of a large number of highly pathogenic bacteria including *Salmonella spp.*, *E. coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

**Keywords:** Hatchery, air-borne contamination, pathogenic bacteria, hygienic level, Algeria.

### Introduction

Infectious problems are a constant threat to the poultry industry development in Algeria, where the state began to encourage especially the production of one day-old chicks by the installation of many broiler hatcheries. These units combine all the conditions (temperature, moisture and organic matters) allowing the development of several pathogens that can affect the chicks health and performances.

The present study aims to measure and identify air-borne bacterial contaminations in different sites within tow broiler hatcheries in the province of Constantine (*North-East of Algeria*).

### Materials and Methods

Bacterial air contamination was examined three days after cleaning and disinfection (after hatching). Open plate air samples were collected at four different places in the setters and the hatcher rooms and at three different levels in setters and hatcher. At each location three Petri dishes containing growth media (Nutrient agar, MacConkey agar and Chapman agar) were allowed to remain uncovered for 10 min as described by Tber *et al.* (1994). Then they were conveyed to the laboratory for incubation at 37°C for 24 hours, after what counts (of the total aerobic flora, *Staphylococci* and *Entérobactéries*) and Identifications of all the *Enterobacteiaceae* (API system 20E and Table-1. Mean air- borne bacteria counts in the different parts of the tow hatcheries (CFU/Petri dish).

serology tests for *Salmonella spp*) and *Staphylococcus aureus* (Coagulase test) were performed.

### Results and Discussion

Tables 1 and 2 represent the different levels and species of bacteria contaminating the air and consequently deposited on the surfaces of materials, eggs and chicks.

Even though the hygienic measures followed in both hatcheries, their hygienic level remains unsatisfactory with the presence of many pathogenic bacteria:

\* *E. coli* : is a saprophyte microorganism that can not be completely eliminated. It is mostly associated with yolk sac infections and omphalitis (Cortes *et al.*, 2004). The contamination of fertile eggs in nests by this bacterium is a major cause of yolk sac infections. The presence of this germ on the egg shells increases the risk of omphalitis and essentially in-shells mortalities. According to Lecoanet (1992a), 15-20% embryonic mortalities, 3-5% in-shell mortalities and 10-20% newly hatched chicks' mortality are strongly related to the contamination of eggs with this bacterium. Cortes *et al.* (2004) reported a mortality rate of 25% during the first week of infected yolk sac chicks' life. Montgomery *et al.* (1999) have recorded a low hatchability rate of eggs contaminated with *E. coli*. The mortality rate of hatched chicks was very low but detectable with a

Setters room	Setters		Hatchers room		Hatchers		Hatchery	
	A	B	A	B	A	B	A	B
<i>Total aerobic flora</i>	169	43	193	22	12	61	10	118
<i>Staphylococci</i>	55	23	55	9	3	28	3	61
<i>Entérobactéries</i>	12	0	18	2	0	2	0	4

Table-2. Air-borne Bacteria identified in the tow hatcheries.

Hatchery	Identified bacteria
<b>A</b>	<i>Salmonella thyphimurium</i> - <i>E. coli</i> - <i>Citrobacter diversus</i> - <i>Proteus mirabilis</i> - <i>Proteus vulgaris</i> - <i>Pseudomonas aeruginosa</i> - <i>Staphylococcus aureus</i>
<b>B</b>	<i>Salmonella thyphimurium</i> - <i>E. coli</i> - <i>Klebsiella pneumoniae</i> - <i>Proteus mirabilis</i> - <i>Pseudomonas aeruginosa</i> - <i>Staphylococcus aureus</i>

decreased body weight. *E. coli* was isolated from the yolk (in large numbers), the lungs and the trachea of hatched chicks (in smaller but detectable quantities).

\* ***Staphylococcus aureus***: Is a very ubiquitous microorganism associated with omphalitis, yolk sac and liver infections in first week dead chicks and in-shell dead embryos (Orajaka and Mohan, 1985; White *et al.*, 2003).

\* ***Pseudomonas aeruginosa***: Is an opportunistic pathogen that can invade and colonize fertile and embryonated eggs causing the in-shell death of embryos and newly hatched chicks (Orajaka and Mohan, 1985). Its colonization of eggs is related to its ability of yolk proteins degradation making the environment conducive to the proliferation and installation of other pathogens (Cortes *et al.*, 2004). The explosion of contaminated eggs in the setters can cause air-borne infections of newly hatched chicks. This bacterium is the biggest threat to the clean zone of a hatchery (Thermote, 2006).

\* ***Proteus Spp***: Has been associated with in-shell embryos mortality (Orajaka and Mohan, 1985).

\* ***Salmonella thyphimurium***: The egg shells were described as the major source of *Salmonella spp* spread in hatcheries. In a study conducted by Cox *et al.* (1990), the isolation rate of *Salmonella spp* was 71% on shell fragments, while Limawongpranee *et al.* (1999) have found a rate of 25% of shell fragments contamination with *S. thyphimurium* and *S. Enteritidis*. Cason *et al.* (1994) during an experiment, found a hatchability rate of 86% of fertile eggs heavily infected with *Salmonella thyphimurium*. All the hatcher's room (especially the air) was tested positive to this bacterium and a significant number of control chicks hatched in the same hatcher's (about 44% of checked chicks) were contaminated. The presence of *Salmonella spp* in the fertile eggs may result in embryonic deaths (at the 6<sup>th</sup> day, but especially after the 15<sup>th</sup> day of incubation) and abnormal hatching (Lecoanet, 1992b). Infected chicks may die with peaks in mortality between the 4<sup>th</sup> and the 5<sup>th</sup> day and by the 15<sup>th</sup> day. A very strong heterogeneity due to reduced feed efficiency and reduced weight gain will be observed with a mortality / disposal rate ranging from 10 to 20% (Lecoanet, 1992b; Chen *et al.*, 2002). According to Friend and Franson (1999), *Salmonella spp* can persist for 4 to 5 years within the hatchery.

\* ***Klebsiella pneumoniae***: Has been reported as one

of the bacteria infecting the yolk sac and causing embryos and chicks mortalities during their first week of life (Orajaka and Mohan, 1985).

\* ***Citrobacter diversus***: Has not been reported in the literature as pathogenic to chicks.

#### Conclusion and Recommendation

In conclusion, it appears that a rigorous cleaning and disinfecting program is a necessity for both hatcheries. The construction of new cabinets and the purchase of large capacity and high technology machines do nothing if good hygienic measures are not undertaken. The owners of these two hatcheries have to undertake immediately remedial actions on defaulting elements.

#### Acknowledgment

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