Pneumonia in Algerian Ouled Djellal sheep: 
Bacteriological study and macroscopic aspect of lung lesions

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Respiratory diseases in sheep are a multifactorial etiology syndrome, causing great economic losses. This study was carried out with the aim of establishing a bacteriological diagnosis of respiratory diseases in sheep, on the basis of lungs with macroscopic lesions taken from sheep slaughtered at the Blida abattoir. A total of 150 samples (swabs and lung parenchyma) from 75 Ouled Djellal sheep, aged six to twelve months old, with pulmonary lesions, were collected to determine possible correlations between the etiological agents and the type of lesion. Hepatization (or consolidation) was the main lesion observed (70%), preferentially localized on the right apical lobe (88% of the cases). This is a special form of pneumonia called atypical pneumonia. A varied microbial flora was isolated, alone or in association, namely bacteria with respiratory tropism as well as others of secondary infection. The bacteria most frequently isolated were γ-hemolytic streptococci (18%), *Escherichia coli* (17.5%), *Micrococcus* species (14.5%), and coagulase-negative staphylococci (10.5%); the large family of *Enterobacteriaceae* represented nearly 43% of the isolates. The pneumotropic bacteria (*Mannheimia haemolytica* and *Pasteurella multocida*) which count for 5.6% of the isolates, turned out to be correlated with the hepatization lesions.

Key words: *Mannheimia haemolytica*, *Pasteurella multocida*, pneumonia, sheep, Algeria.

INTRODUCTION

Sheep farming in Algeria constitutes 50% of the agricultural gross domestic product. The sheep number has increased from 17.5 to 26.6 million head with an average annual increase of 4.4% over the ten-year period (2003 to 2013) (MADR, 2014). In 2003, it represented 25 to 30% of animal production and 10 to 15% of agricultural production. It provides more than 50% of the total meat needs of the country (Abdelguerfi and Ramdane, 2003). The rearing of grazing livestock in Mediterranean countries includes 13% of the world's sheep and goats (Boutonnet, 1998). Respiratory diseases in sheep are among the most frequent pathologies, with heavy health and economic impacts. They form a multi-factorial complex involving the interaction of host, environment,
as well as a wide variety of pathogens. The term respiratory disease complex (RDC) is used for the condition conventionally known as bronchopneumonia. RDC is a polymicrobial infection that develops when the immune system of the animal is compromised by stress factors such as crowding, transportation, draught and inclement weather combined with increased exposure to pathogens, and may lead to respiratory infection (Asaye et al., 2015).

Environmental conditions and poor hygiene prevailing in Algerian farms are all stress causing factors that promote the onset of respiratory diseases. When they do not involve the death of the subject, they result in debilitating medical conditions and therefore a decreased carcass value. Indeed, respiratory troubles in lambs cause mortality, growth reduction and economic losses, due to drug costs and condemnations in abattoirs (Goodwin et al., 2004). The role of stress in the natural incidence of the pulmonary form of pasteurellosis is clearly highlighted by the fact that the disease onset is associated with a sudden source of stress such as exposure to an extreme temperature (hot or cold) with a high level of humidity, overcrowding, poor ventilation, bad raising practices, rough handling, transport over long distances, excessive dust, high load of internal or external parasites and the mixing of animals from different sources (Sharma et al., 1990; Martin, 1996).

Small ruminants are especially sensitive to respiratory infections, mostly as a result of deficient management practices that make these animals more susceptible to infectious agents. The tendency of these animals to huddle and group rearing practices further predispose small ruminants to infectious and contagious diseases (Chakraborty et al., 2014). In a study in Ireland, McIlroy et al. (1989) demonstrated a significant correlation between the percentage of seized sheep carcasses due to pleurisy or pneumonia and rainfall, wind, temperature as well as humidity. Galapero et al. (2016) used Bayesian networks to identify risk factors for pulmonary consolidation. The results showed that the main factors causing ovine inflammatory respiratory processes and pulmonary consolidation were temperature, relative humidity, and Mycoplasma species. Control of these factors may help reduce the incidence of pulmonary consolidation. In sheep, the pathogenesis of respiratory diseases is difficult to determine because of the interaction of different causative agents which may have similar pathological models (Alley, 1975). Of all the organ systems, the respiratory tract may be unique in its vulnerability to injurious agents. Nowhere else in the body, such a vast surface area (approximately 100 m²) is directly exposed to airborne pathogens at about 20 times/min. Not only is the area and exposure extreme, but the underlying blood circulation is only two cell layers of about 0.5 nm each, removed from the alveolar surface (Asok et al., 2014).

Previous or combined infection with some respiratory viruses may increase the susceptibility of farm animals to secondary bacterial pneumonia (Cutlip et al., 1993; Ozyildiz et al., 2013). Sheep are particularly sensitive to parainfluenza virus type 3 (PIV-3) and bovine respiratory syncytial virus (BRSV); antibodies against these viruses have been demonstrated in this species (Lemkhuhl et al., 1985; Giangaspero et al., 1997). An estimated 40% of viral respiratory infections are complicated by bacterial pneumonia (Loosli, 1968). Pasteurella, which is the main bacteria responsible for lung disease in sheep, acts as secondary infection agents after a viral or mycoplasma infection (Douxart, 2002). Whatever the initial cause of lung damages is (environmental, viral, bacterial or parasitic), Mannheimia haemolytica is often found as a complicating agent. Ovine pneumonia due to M. haemolytica is the major cause of perinatal mortality (10 to 40%) depending on the farm type and the season (Malone, 1988). In outbreaks of acute ovine and caprine pneumonia, Pasteurella especially M. (Pasteurella) haemolytica and Pasteurella multocida have been isolated more than other pathogenic agents from affected lungs. About 30% of domestic animal mortality is known to be related to Pasteurella infection (Valadan et al., 2014).

Pasteurellosis, also called "enzootic pneumonia", does not correspond to a specific nosologic entity, but Pasteurella, which are the most frequently isolated pathogens, are therefore considered as the main cause of the disease (Zrelli, 1988). Atypical pneumonia is defined to distinguish a rather similar form of pasteurellosis, but without the fatal nature of this latter (Rouchy, 1992), combined with a multitude of pathogenic agents including Mycoplasma ovipneumoniae. Due to the high losses resulting from these pathologies and considering the importance of the national herd (over 26 million heads), it was deemed appropriate to carry out an investigation to determine a first estimate of the prevalence of pneumonia in sheep, by studying pulmonary lesions observed in the slaughter house to try and establish a link between macroscopic lung lesions and bacterial agents, especially Pasteurella species.

MATERIALS AND METHODS

The study focused on sample "all comers" of Ouled Djellal sheep slaughtered at Blida abattoir (Algeria) from January 2009 to April 2010. These animals came from different farms and neighboring regions of Blida (15 km from a large cattle market), where farming conditions are substantially the same. It concerned only males, aged 6 to 12 months.

Blida is located at 36°28’North and 2°49’ East, at an altitude of 272 m above sea level. It extends over 1478.62 km². The temperatures in the area vary from 2°C in winter (January) to 45°C in summer (July) and the average annual precipitation is around 600 mm per year, reaching its peak from December to February (30 to 40% of annual precipitation).

According to the local agriculture service, the number of sheep in the study area is about 40,000 heads. Blida abattoir was selected because it is the largest in the region in terms of slaughter
Table 1. Frequency distribution of gross pathological lesions in lungs of sheep observed at Blida slaughterhouse.

<table>
<thead>
<tr>
<th>Lesion</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red hepatization</td>
<td>39</td>
<td>52.0</td>
</tr>
<tr>
<td>Grey hepatization</td>
<td>14</td>
<td>18.7</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>10</td>
<td>13.3</td>
</tr>
<tr>
<td>Emphysema</td>
<td>8</td>
<td>10.7</td>
</tr>
<tr>
<td>Others*</td>
<td>4</td>
<td>05.3</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Congestion, Abscesses.

capacities (around 500 head of sheep/day).

Macroscopic study of lung lesions

A survey sheet was established for each animal with lungs lesions. The lesions were described according to its precise location, degree of expansion, appearance (color), consistency, volume, shape and the nature of the macroscopic pathological changes.

Lesion score

For each lobe, the extent of the lung lesion was visually evaluated and measured using a 4-point scale, from score 0 (no injury), score 1 (≤ 25% of the lobe), score 2 (25 to 50%), score 3 (50 to 75%) to score 4 (> 75% of the lobe). The overall score was obtained by summing the scores for each lobe between 0 and 32.

Sample collection

A total of 75 bronchial swabs and 75 lung parenchyma were collected for bacteriological analysis. Two samples types were taken from freshly slaughtered animals with gross lesions suggesting pneumonia: a swab of the bronchi using a sterile swab after sectioning of the injured tissue, and sectioning a fragment of pulmonary fabric from the same compromised parenchyma.

These samples were placed in insulated boxes at +4°C, to be sent to the laboratory as soon as possible. For practical reasons, the samples were frozen (-20°C) in order to be exploited subsequently. Each sample, properly identified and accompanied by an identification card was placed in airtight individual packaging, which no added preservative or antiseptic.

Bacteriological analysis

The bacterial analysis carried out at the Microbiology Laboratory of the Veterinary Institute (University of Blida) focused on the isolation and identification of conventional bacteria involved in the pathological process, according to current bacteriological techniques recommended by Quinn et al. (1994).

Viruses and Mycoplasma were excluded from the search because they require specialized culture conditions and identification techniques. In the laboratory, the samples were thawed at ambient temperature. The surface of the lung fragment was cauterized on the surface; the parenchyma was cored with an unbuttoned Pasteur pipette and placed in nutrient enrichment broth (manufactured by Pasteur Institute of Algeria, IPA) to revitalize bacteria (37°C for 18 to 24 h), while the swabs were directly and separately placed in similar broths.

The enriched broths were seeded on agar with 5% sheep blood (IPA) incubated under aerobic conditions at 37°C for 24 h. Morphological characteristics of colonies were scored on blood agar, as well as the presence or absence of hemolysis, the type of this latter and the production of pigments and smells. After purification, Gram stain, catalase and oxidase tests were performed. The choice of the identification gallery was established from the results of these tests.

RESULTS

Prevalence of pulmonary lesions

From 1018 slaughtered and examined sheep during the survey, 194 (19%) had pulmonary lesions, isolated or in combination, of varying nature and severity. The lesions appearing to be infectious (n = 75) were sampled. The rest of the observed lesions (n=119) were either parasitic in nature or slaughter injuries and were not taken into account for the result of the investigation.

Distribution of the lesion types

Infectious pulmonary lesions can be divided into 4 categories: red hepatization, grey hepatization, atelectasis and emphysema. Pulmonary hepatization (also called consolidation injury) represented the most frequent lesion observed in the slaughter house; all forms included, it represents 70.7% of the lesions (Table 1). Considering that different lesions sometimes occur in the same lung, only the dominant one was considered.

Location of lesions

Pulmonary lesions mostly sits on the apical lobes, the right one in particular (88% of the inspected lungs), reaching either part or all of these, and sometimes extends to other lobes (Table 2). Lesion frequency is higher on the right side of the lung, with a marked laterality for apical lobes (Figure 1).

Scope of lung injury

Determining the extent of the pulmonary lesion on each lobe permits us to estimate the evolution of the pathology. The scale of lung lesions depends on the severity and extension rate of pneumonia (Table 3). We note that the apical right lobe is frequently affected in its entirety.

Lesion score

Lesions extending on small areas are the most prevailing; three quarters of the examined lungs showed a lesion...
score smaller than 5/32. The average lung score was equal to 5.26 ± 5.22, while the number of animal per injured lobes was 1.82±1.63. Lung lesions extend widely over the different lobes. The perimeter areas where pneumonia is evolving are irregular.

**Bacteriological analysis results**

Bacteriological analysis was performed on 150 samples from 75 animals. The samples were 75 fragments of lung and 75 bronchial swabs of the same lungs with lesions. The most frequently isolated bacteria were gamma-hemolytic streptococci (18%), Escherichia coli (17.7%), Micrococcus species (14.5%) and coagulase-negative staphylococci (10.4%). The family of Enterobacteriaceae (E. coli included) represents nearly 43% of the isolates. M. haemolytica and P. multocida account for 5.6% of isolates.

Most bacteria isolated (71%) were either saprophytes or commensals of the upper respiratory system and represent commonplace bacteria contamination (Bacillus, Proteus, Micrococcus). Others (E. coli, Klebsiella pneumoniae, Staphylococcus aureus, Pseudomonas, Streptococcus β-hemolylotics) which account for 23%, are occasional specific pathogenic agents of the respiratory system, and may be pathogenic in secondary infections due to a decrease in immune defenses of the host. The role of the M. haemolytica and P. multocida (5.6%) is well known in respiratory diseases in sheep (pneumotropic bacteria) (Figure 2).

Several associations of bacterial species were isolated in the same sample (Figure 3). Out of the 150 samples (75 swabs and 75 lung parenchyma), 54 (36%) were mono-microbial, 87 (58%) indicated the association of two bacterial species and 9 (6%) showed three. All samples showed bacterial growth; none were sterile. This combination of bacteria in one sample reflects a multifactorial etiology of lung disease of sheep and explains the diversity of the observed lesions. Comparison of the results obtained by the two samples types highlights a greater number of bacterial flora, from the swabs.

According to these results, there seems to be no relationship between bacterial groups and sample type (Figure 4). Pneumotropic bacteria were isolated only in hepatization lesions (Table 4).

Despite the small number of pneumotropic bacteria (M. haemolytica and P. multocida) isolated in this study, their exclusive frequency (14/14) should be noted in the consolidation lesions (hepatization).

**DISCUSSION**

Sheep farming in Algeria represents the main source of income for many families in rural areas. Ouled Djellal sheep are the most common breed of sheep, accounting for more than 60% of the national herd. They provide a lot of meat, wool and leather, and are particularly suited to the arid climate. However, the important variations in temperature, ranging from hot in summer to very cold in winter, can promote the development of sheep respiratory diseases. Indeed, previous studies in France (Douart, 2002), Algeria (Belkhir et al., 2008) and India

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**Table 2. Distribution of pulmonary lesions observed in the lobes.**

<table>
<thead>
<tr>
<th>Lung</th>
<th>Lung lobes (n=75)</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Lung</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right apical</td>
<td>66</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Anterior medium lobe</td>
<td>14</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Right lung</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterior medium lobe</td>
<td>08</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Right caudal lobe</td>
<td>07</td>
<td>09</td>
<td></td>
</tr>
<tr>
<td>Azygos lobe</td>
<td>03</td>
<td>04</td>
<td></td>
</tr>
<tr>
<td>Left lung</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left apical lobe</td>
<td>13</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Left medium lobe</td>
<td>09</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Left caudal lobe</td>
<td>04</td>
<td>05</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1.** Total red hepatization (or consolidation) of the apical and medium lobes of the lung, taking the color and consistency of the liver (dorsal view).
Table 3. Extent of lung lesions in sheep observed at the abattoir.

<table>
<thead>
<tr>
<th>Extent (%)</th>
<th>Left Lung (3 lobes)</th>
<th>Right Lung (5 lobes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apical</td>
<td>Medium</td>
</tr>
<tr>
<td>0</td>
<td>62</td>
<td>65</td>
</tr>
<tr>
<td>&lt; 25</td>
<td>05</td>
<td>02</td>
</tr>
<tr>
<td>25-50</td>
<td>05</td>
<td>05</td>
</tr>
<tr>
<td>50-75</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>75-100</td>
<td>01</td>
<td>00</td>
</tr>
<tr>
<td>100</td>
<td>02</td>
<td>03</td>
</tr>
</tbody>
</table>

Figure 2. The prevalence of pathogenic bacteria isolated from pneumonic lungs of sheep slaughtered.

Figure 3. Bacterial associations by sampling procedure.

(Dar et al., 2012) have determined a significant incidence of lung lesion in sheep during winter. In regard to the unavailability of some laboratory techniques, the results of the investigation lack precision, particularly because of the difficulty to look for Mycoplasma and viruses, which are much involved in lung lesions in sheep.

The molecular diagnosis of Pasteurella spp. isolates
which includes analysis of nucleotide sequences of the 16S rRNA and \textit{KMT1} genes overcame the disadvantage and limitation of phenotypic diagnosis and became a favorable technique in many international laboratories for identification and calculating the phylogenetic tree in \textit{Pasteurellaceae} family. It reduces the duration of identification, allows a direct detection of organisms from clinical sample’s genome, and enhances the sensitivity and specificity of the diagnosis (Hassan et al., 2016).

Polymerase Chain Reaction (PCR) is a sensitive and rapid diagnostic procedure for the early diagnosis of \textit{Mycoplasma} infection. \textit{M. ovipneumoniae} has been isolated and detected through PCR from the nasal swab samples and from pneumatic sheep lungs (Amin et al., 2016).

In Algeria, Kabouia (2005) highlighted the association of \textit{Mycoplasma} with different types of lung lesions in 21% of sheep samples. \textit{Mycoplasma capricolum} alone or in combination with other mycoplasmas (\textit{Mycoplasma agalactiae} and \textit{M. ovipneumoniae}, \textit{Mycoplasma arginini}) and other bacteria are responsible for ovine respiratory diseases. In Richard et al. (1986) in France, isolated \textit{M. ovipneumoniae} in more than half of pneumonia lesion samples from sheep. Statistically highly significant difference (Fisher’s exact test \( P \leq 0.0001 \)) in the isolation of \textit{M. ovipneumoniae} between healthy and respiratory distressed sheep breeds in Balochistan (Pakistan) was found (Amin et al., 2016). The sampling is not random because it is not based on any lot. It is not representative of the ovine population, at least that of the Bliida region. Despite this lack of representativeness, the results identified in this study...
make it possible to learn about relationships that may exist between the lesions and pneumotropic bacteria. The selected animals cannot be considered as representative of the sheep population of the study area, given that the only criterion for inclusion is that the animal, regardless of age or sex, arriving at the slaughterhouse showed macroscopic lung lesions, infectious and non-parasitic. Moreover, we had no information about their mode of rearing or any recent antibiotic treatments. The examined animals were all males, 6 to 12 months. For practical reasons, the samples had to be frozen pending their exploitation, despite the fact that some works showed a deleterious effect of freezing on the number of species isolated in the pulmonary bacteriology (Menoueri, 1985; Cadoz, 2000). The effect of freezing can be ambivalent; it can be negative by reducing the probability to isolate Pasteurella and even completely eliminate it, including the pneumonia principal agent; on the other hand, it can be beneficial by preventing the development of bacteria that proliferate in the post mortem process.

Our study showed a prevalence of 19% lung lesions. In the large scale study of Goodwin-Ray et al. (2008) carried out on about 2 million lambs slaughtered in three abattoirs in New Zealand, the prevalence of pneumonia ranged from 7 to 13% per slaughter house. An abattoir survey realized by Brunet and Fontaine (1980) in France showed that on more than 25,000 inspected lambs, 35% had pulmonary lesions. In other countries, the prevalence of pneumonia in not frozen samples was found as follows: 15.28, 22.48 and 18.93% in India, respectively in 2013, 2014 and 2016 (Priyadarshi et al., 2013; Asok et al., 2014; Amaravathi et al., 2016); 7.8% in Tanzania (Mellau et al., 2010); 4.2% in Iran (Azizi et al., 2013), 27.84% in Algeria (Belkhirri et al., 2014). Pneumonia lesions observed in our study, affected preferentially apical lobes (88% of the cases). The predominance of the lesions in cranioventral portions of lung has been attributed to shortness and abrupt branching of air ways, greater deposition of infectious organisms, inadequate defense mechanisms, reduced vascular perfusion, gravitational sedimentation of exudates and regional differences in ventilation (Dar et al., 2013).

In most domestic animal species, the right cranial lobe is ventilated down by the cranial bronchus, with the exception of ruminants and pigs lobe where it is ventilated by an additional bronchus which lies just before the tracheal bifurcation (Nickel et al., 1973). The higher frequency of lesions on the right side of the lung and the increased vulnerability of apical and cardiac lobes are similar to those described by Alley (1975), Haziroglu (1994), Ozyildiz et al. (2012) and Dar et al. (2014); this is a special form of pneumonia called chronic or atypical pneumonia.

Bacterioiological results showed a diverse bacterial flora in the lungs as well as in the bronchial liquid, predominantly gram positive, similar to the results of Garedew et al. (2004) in Ethiopia. The results indicated in this study, including the relatively small number (5.6%) of Pasteurella isolation are to be kept with a sense of proportion. It is possible that these results were due to the fragility of the bacteria that have not withstood the samples storage conditions. As concerns in pneumonic lungs, the results of isolates of M. haemolytica (without freezing) were the following: 21.96% (Marru et al., 2013), 34.1% (Demissie et al., 2014), and 14.7% (Asaye et al., 2015) in Ethiopia; 22.20% (Kaoud et al., 2010) and 14.3% (Saed et al., 2015) in Egypt, respectively.

According to Cadoz (2000), M. haemolytica was isolated twice as often when there was no freezing, while most of the bacteria resist, at least partially, freezing. According to Meyer et al. (2004), freezing has no real bactericidal effect; for the most sensitive microorganisms (gram-negative), the population is reduced by a power of 10 by freezing (that is 90% destroyed) and again the power of 10 during prolonged storage. If the population is large at the time of freezing, it will be so after storage and thawing.

In their study, Tehrani et al. (2004) attributed M. haemolytica low isolation either to antibiotic treatment or to the development of other bacteria such as Proteus species and Bacillus species which would mask the presence of Pasteurella or chronic lesions that would promote growth of other bacteria. Bacteria similar to those identified in our study were isolated from sheep with pneumonia. This is the case of Richard et al. (1986) in France; Al Sultan (1995) in Iraq; Barbour et al. (1997) in Saudi Arabia and Yimer and Asseged (2007) in Ethiopia, with substantially similar proportions. The distribution of different bacterial groups is relatively similar to that found by Menoueri (1985) in France on housed lambs with the difference that he studied in addition with the presence of Mycoplasma spp. (12%).

The isolated bacteria from the diseased lungs of the animals studied were dominated by streptococci gamma-hemolytic and E. coli which are opportunistic pathogens and develop in parallel to primary pathogens during an infectious phenomenon (Richard et al., 1986). Streptococci were isolated in 18% of the cases. They are part of the normal flora of the upper respiratory tract and are considered opportunistic pathogens (Kaoud et al., 2010). Escherichia coli is extremely widespread in the environment, developing more whenever there is contamination of the sample. Its presence in the lungs can possibly result from the evolution of septic processes. In our study, the predominance of E. coli was also highlighted by Mohammed (1999). Robbins et al. (1981) reported that S. aureus colonizes the upper respiratory tract, become involved in the disease process when stress conditions prevail. According to Richard et al. (1986), the greater concentration of the bacterial flora obtained from the swabs (132 species isolated against 117 for parenchyma) could be explained by the presence of bacteria in the
open air, which are absent from the lung parenchyma or contamination during handling. Swabs appear much more polluted with contaminants such as the common Micrococcus, Proteus and Bacillus. The isolation of M. haemolytica and/or P. multocida, specifically the correlation between these bacteria and lung injury called consolidation (hépatization) corroborate the findings of Sharp (1978), Jones et al. (1982), Peiffer (1983) or Daniel et al. (2006).

For Cadoz (2000), the involvement of M. haemolytica increases with further damages. According to Garedew (2004), a strong correlation was observed between the presence of Pasteurella and the development of pneumonia in sheep. Moreover, according to Kaoud et al. (2010), M. haemolytica plays a more important role in respiratory diseases of sheep and goats (14%) than in cattle (3.6%).

Our study aimed to determine the situation of sheep, sacrificed at the slaughterhouse of Blida, vis-à-vis respiratory diseases based on pathological and bacteriological investigations. The infection rate found reached the considerable figure of 20% of the total slaughtered animals. Bacteriological results showed the presence of a wide variety of bacteria, including pneumotropic germs (M. haemolytica and P. multocida), isolated up to 5.6% and strongly correlated to hepatization which represents 70% of lesions on lungs. The low percentage of isolation of these bacteria is probably due to the freezing of the samples. These germs caused pneumonia in young animals (under one year), primarily localized on the apical right lobe (88% of cases). It was also noted that the nature of isolated germs is independent from the sample type. These results reflect the existence of atypical pneumonia in sheep populations in Algeria; this pathology should be taken into consideration, because of its harmful impact on the health and growth performance of young animals. Further studies aiming to know the different serotypes of these agents that prevail in the country will allow the development of a vaccine. Research of Mycoplasma and viruses, including parainfluenza, which are very involved in respiratory diseases, is strongly recommended too.

Conflict of Interests

The authors have not declared any conflict of interests.

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