

*Full Length Research Paper*

## Primary disease dairy herds in North-eastern Algeria

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The serums coming from 450 dairy cows have been analyzed for the detection of brucellosis. The rate of prevalence of the infection is 10.44%. The test of the intradermotuberculation for the detection of tuberculosis showed that the rate of prevalence of the infection is 08.22%, with a significant difference ( $p < 0.05$ ) between the individuals of 2 years and those of more than 4 years. All studied sanitary troubles were present for a whole year, with a predominance of the mastitis, especially in the beginning of spring where the prevalence attained 44.88%, and/ or reproduction unrest was 14.88%. Respiratory trouble especially appeared in winter, with a peak of 21.77%. The digestive troubles were at the rate of 11.11% in spring, whereas the parasitosis and the piroplasmosis reached their maximum of 21.55% in summer. The locomotive troubles were constantly present all through the year in the same beasts practically, with an estimated peak of 18.22% in winter, which showed that the season has an effect on the emergence of these different troubles with valour of high significance ( $p < 0.001$ ).

**Key words:** Tuberculosis, brucellosis, bovine mastitis, reproduction disorders, respiratory disorders, digestive disorders, piroplasmosis, lameness, seasonal prevalence, primary disease, North-eastern Algeria.

### INTRODUCTION

Like a lot of developing countries, Algeria had always resorted to the yearly import of massive quantities of milk and score of thousands output of bovine dairy (Bourbia, 1998; Haddad, 2001). This provision to the level of the world market will certainly persist in years to come considering the importance of the present raw milk deficit (Tisserand and Fevrier, 1989). The performances of production of the Algerian dairy bovine livestock appear very low to the fixed objectives (Bourbia, 1998). Indeed, in all exploitation of bovine, the females are destined to assure a dairy production and/or of maximal meat. However, several factors such as food, therapeutic, pathological nature or management are susceptible to spoil the reproductive ability and productivity of these animals, which essentially result in a decrease of the dairy production (Fourichon, 2001). The sanitary problems constitute an important constraint for the

development of the dairy bovine raising; the economic impact of the health unrest on the French dairy raising is estimated on average to be €232 per cow (Fourichon et al., 2001). Only a third of this cost is caused by the expenses on health. The two third remaining is due to the induced losses that correspond to the resulting loss of profit, which is caused by the effect of the illnesses on the reached animals. The estimating cost of the pathologies in raising animals consists of the veterinary fees, the cost of the treatments, analyses and possible vaccinations (Seegers et al., 2002) to which it is necessary to add the bearish consecutive losses of milk production, the effects of the disease on the quality of the products (rate, cells, weight of carcass) and on reproduction. The longevity of the animals is often difficult to encode (Fourichon, 2001; Fourichon et al., 2001). The objective of the present work, that took place in the North East Algerian zone well known by its dairy bovine raising density, was to detect the emergence of the afflictions and diseases of the dairy raising and to arrange their seasonal importance in order to define the priorities of action and to put preventive

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actions to the upstream of these pathologies.

## MATERIALS AND METHODS

### Presentation of the research farms

Our study took place in the region of Tarf El situated in the zone extreme North East of Algeria, border to Tunisia. It occupies a surface of 300,000 ha and is limited at the north by the Mediterranean Sea. The recorded middle pluviometry varies between 600 and 800 mm/an. The humid period spreads from September to May and it represents 95% of the yearly pluviometry. The average temperatures vary from 11 in winter to 25°C in summer. The lowest temperatures are recorded in the month of January; the maximum appears in July and August. The middle relative humidity varies between 71 and 79%, the minimum being located between 43 and 53% and the maximum between 92 and 96%. The different fodders cultivated in the region are: the vesse oat, the barley, the fodder corn, the fodder sorghum to quote it of the hay of natural prairie, alfalfa and clover. The farms of study are buildings of raising follow-ups by private breeders, sheltering some animals in free rest cure. All aspects of the comfort of the animals are not satisfied.

Our study was about 450 cows of Holstein race magpie black exploited for their dairy production, aged between 2 and 6 years, belonging to four raisings located in the region of EL Tarf during four years, from September 2002 to 2006.

These farms practice a rising in free rest cure with logette. The abreuvement is automatic, while the mechanical bill, the mode of reproduction is assured by increasing natural and artificial insemination. The food consists mainly of green grass or clover, of extract, tomato residuals, hay and ensilage.

### Personal follow-up

During our personal follow-up, we listed the observed pathological cases in relation to the clinical signs, how to treat the sickness, how to track down the dairy cows against the brucellosis, tuberculosis and mastitis and tried to make diagnostic treatments, especially against some parasitosis. In most cases, we rely more on symptomatic statement to make for real etiologic diagnosis for the identification of the pathologies (Miller and Dorn 1990; Fourichon et al., 2001). We present the list of the definitions of the pathological trouble retained for the survey below:

**Digestive trouble:** Digestive signs include diarrhea, indigestion, meteorisation, foreign body.

**Respiratory trouble:** Respiratory signs include cough, difficulties in breathing, out-flows to the nostrils and pulmonary attacks.

**Locomotive unrests:** Lameness.

**Trouble of reproduction:** Metriteses, vaginitises and abortions.

**Parasitism:** Strongylosis, fasciolosis, coccidiosise, piroplasmosis, burrs and ticks.

All received data have been treated with the help of the software Minitab 2005; the significance of the observed differences is appreciated by Chi Two low (Lazar and Schwartz, 1987).

### Biological taking and methods of laboratory analysis

#### Detection of the brucellosis

Blood has been collected by puncturing of the jugular vein in sterile

tubes without anti-coagulating and it has been centrifuged to 10000 rpm for 10 min. Some of the harvested serum was kept in - 20°C until the moment of the analysis. The test in the pink Bengal has been achieved according to the method described by Morgan et al. (1969). The positive cases have been confirmed by the reaction of complement fixation (Alton, 1988).

#### Detection of the tuberculosis:

The Intra Dermo Tuberculation (IDT) sample, with the PPD tuberculin (purified proteinic Derivative) normal measured out in 20,000 UCT/ml (Communal Units of Tuberculin) has been used (Chaloux and Ranney, 1974). The positivity of the test has been valued according to the following protocol:

J0: measure of the thickness of the dermis (D1) and intradermal injection of bovine tuberculin purified.

J3 that means 72 h later: measure of the thickness of the dermis (D2) and calculation of D2-D1.

The interpretation of the results has been done as follows: If  $D2 - D1 < 2$  mm, the reaction is negative; if  $2 \text{ mm} < D2 - D1 < 4$  mm, the reaction is doubtful; if  $D2 - D1$  is superior to 4 mm, the reaction is positive (Benet, 1996).

#### Detection of the mastitis:

Deducted samples of milk in sterile tubes of 25 ml have been used to measure the value of the prevalence of the mastitis by the California Mastitis Test (CMT) (52, 53, 26, 35 and 18).

## RESULTS

### Tuberculosis and brucellosis

For the brucellosis, the number of positive animals is of 47, either a prevalence observed of 10.44%. With a limit of risk.  $\alpha = 0,05$  we have one confidence interval that situating between 0.0794 and 0.1362. For the tuberculosis, the number of positive animals to the IDT is of 37 either a prevalence observed of 8.22%. With a limit of risk.  $\alpha = 0,05$  we have one confidence interval that situating between 0,0602 and 0,1113. This prevalence increases distinctly with age. A significant difference between the animals of 2 years and those aged of more than 4 years ( $p < 0.05$ ) has been observed. Table 1 indicates the effect of age on the seroprevalence of the two diseases.

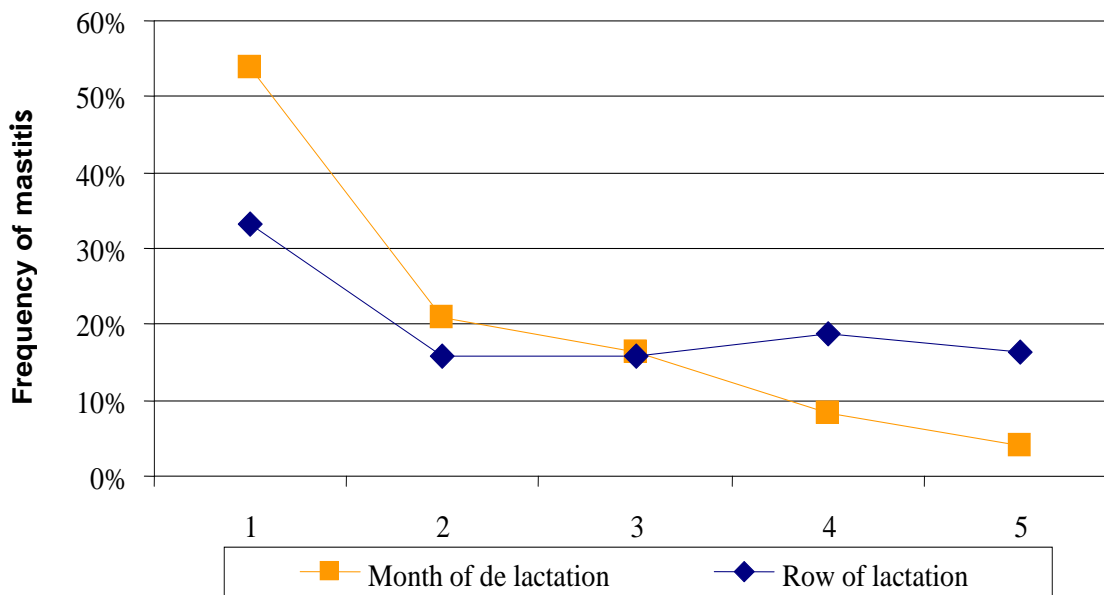
### Mastitis

On the 450 studied dairy cows, 68 presented signs of clinical mastitis during the period of lactation (beginning of the spring), with a prevalence of 15.11%. The samples tested by the Californian Mastitis Test (CMT) showed that 134 dairy cows had a sub-clinical mastitis, with a prevalence of 29.77%. Figure 1 represents the distribution of the cases of mastitis (clinics and sub-clinical

**Table 1.** Effect of age on the seroprevalence of the brucellosis and the tuberculosis.

Age (years)	Brucellosis (%)	Tuberculosis (%)
2.5 – 4	22 (4.88)	25 (5.55)
> 4	02 (0.44)	35 (7.77)

(\*) Number of positive animals.



**Figure 1.** Frequency of the mastitis according to the the stage and the row of lactation.

disconcerted) according to the stage of lactation and the row of lactation. It also indicates an impact raised rightly of the mastitis after the calving followed by a regular decrease. Elsewhere, we remark a reduction, then a stabilization of the impact of the mastitis with the row of lactation.

### Other pathologies

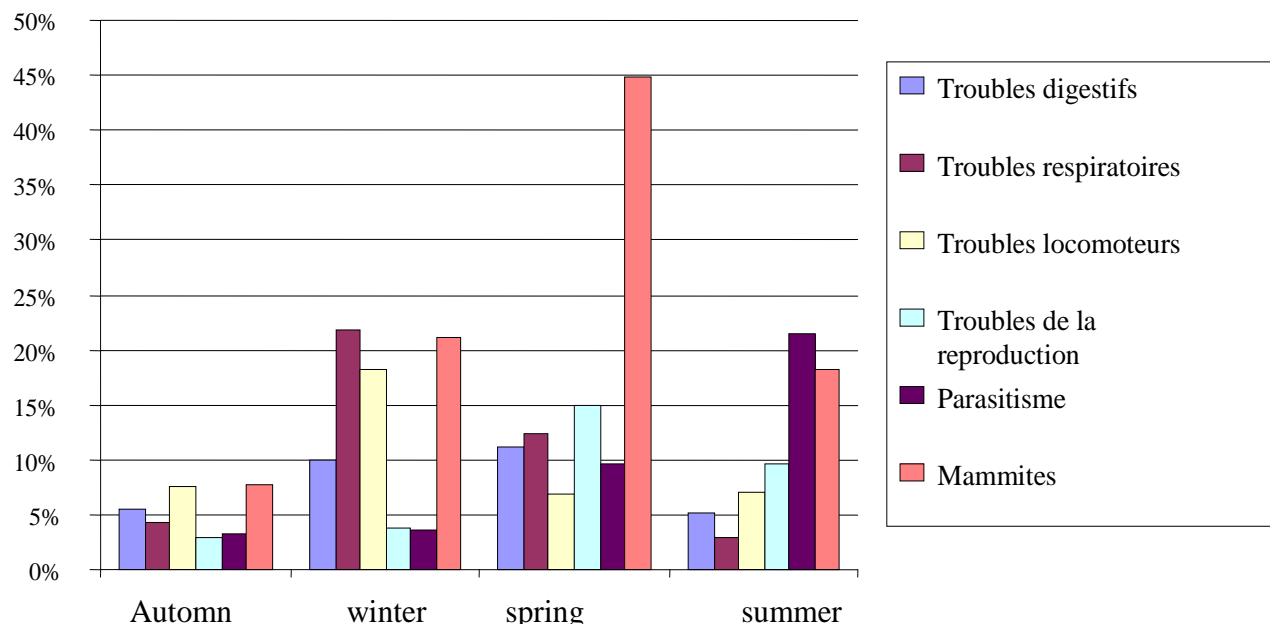
The studied troubles were present throughout the year (Figure 2). The most frequent pathology was especially the mastitis at the end of winter and in the beginning of spring where the prevalence reached 44.88% and where the trouble of reproduction at the low stake was 14.88%. The apparition of the respiratory troubles is especially important in winter with a peak of 21.77%. The digestive troubles were 11.11% in the spring, whereas the parasitism (especially the piroplasmosis) reached its maximum in summer with 21.55%. The locomotive troubles are constantly present all along the year in the same subject practically, with estimated peak of 18.22% in winter. In the light of these results, the season has a highly significant effect on the presence of these different troubles ( $p < 0.001$ ).

### DISCUSSION

The seroprevalence of the brucellosis recorded in our study is of 10.44%. It is superior to the one reported by other authors who studied the disease in Algeria, (Aggad, 2002; Aggad, 2003) in Libya (El Sanousi and Omer, 1985), Morocco (Radicon, 1998) and in Tunisia (Refai, 2002), with rates inferior to 5%.

It demonstrates that the bovine brucellosis is persistent and it rages at the endemic state with frequent epidemic blazes Boudilmi and Benhabylles (1991), which is in agreement with an insufficient detection of the livestock. The bibliographic information on the prevalence of the bovine tuberculosis is very rare Benkirane (1998) and the elements of comparison are therefore limited. Nevertheless, the prevalence of 8.22% is widely superior to the value of 1.82% found in Morocco (Fikri, 2004), but distinctly lower to those related by Akakpo (1987) for Niger (18.3%), Togo (22.5%) and (Traore et al., 2004) Burkina-Faso (27.7%).

The prevalence of the infection increases with age of 0.44% (Fikri, 2004) among cows of 2 to 4 years and 7.77% among those of more than 4 years. It can be explained by the fact that the brucellosis is of chronic nature and the possibility of exposure that increases with



**Figure 2.** Global seasonal prevalence of the main pathologies (unrest).

age (Acha and Szyfres, 1989) for dairy bovines that have a long enough economic life.

The prevalence of the clinical mastitis is 15.11%. This value is lower than the prevalence of 32.6% reported by Bouaziz et al. (2000), 23.1% by Koutchoukali (2000) in the region of Constantine, the east of the Algeria, 42.2% by Niar et al. (2000) in the region of Tiaret to the Algerian west, 30% by Rahmouni and Mazouz (2003) in Morocco, 29% by Rahmouni and Mazouz (2003) and 31.7% by Faye et al. (1994) in France.

The CMT stay in our study is the best test to detect the sub-clinical mastitis (Ruegg and Reiman, 2002). The results indicate a prevalence of 29.77% that is lower than the one of 50% observed by Heleili in Morocco (Heleili, 2002), of 64% in India (Saxena et al., 1993), of 62% in Ethiopia (Deogo and Tareke, 2003), of 52% in Uruguay (Giannechini et al., 2002). On the other hand this prevalence is superior to the one of 5 and 25% reported by Pluvinage et al. (1991). The frequency of the clinical mastitis is raised more in the beginning of the lactation, which is in agreement with the results of several studies (Rahmouni and Mazouz, 2003; Bazin, 1983; Wilesmith et al., 1986; Erskine et al., 1988; Elbers et al., 1998; Waage, 1998; Peeler et al., 2002). It underlines the importance of the prevention in the beginning of the lactation and to the tarissement.

One also notes that the impact of mastitis increases with the rank of lactation. It is marked more among the aged cows, these observations are in agreement with the observations signalled by other authors (Dohoo et al., 1984; Wilesmith et al., 1986; Morse et al., 1987; Bendixen et al., 1988; Sargeant et al., 1998).

In our study, the mastitis takes care of the first rank of

the troubles of the dairy cow, which agrees with several results of other works (Kossaibati and Esslemont, 1997; Miller and Dorn 1990; Sischo et al., 1986, 1987, 1990; Niar et al., 2000). Then comes the troubles of reproduction, respiration and digestion. It is different from what has been observed by Mouchet et al. (1986) and Pieters (1989) who signal a rate of importance of the metabolic illnesses classified in second position. These differences can be explained by contexts of different raisings between these two studies.

Concerning the lameness, our results are in agreement with those of Desrochers (2005) who reports a frequency of 2 to 30% whereas Esslemont (1990) notifies a frequency of 4 to 30%.

The parasitic trouble which rates are constant in autumn, winter and in spring, principally of the digestive and respiratory parasitosis, increases in summer with a rate of 21.55% that corresponds to a blaze of bovine piroplasmiasis. It is about disease transmitted by the ticks causing heavy losses within the livestock bovines with an especially summery impact (July, August). The theileriosis and babesiosis constitute a major hindrance to the development of raising. Clinically, the disease results in a sharp access that lasts about fifteen days, characterized by an elevated and continuous hyperthermia with a strong mobilization of the phagocytic cells. The mortality reaches 20 - 40% often (Rouina, 1983, 1984). A rate of infection of the dairy bovines of 39.04% in July-August has been reported by Dib (2005) in north of Algeria. In Tunisia, Bouattour (1996) reported that the piroplasmiasis constitutes the principal dominant pathology affecting the Tunisian dairy bovine from increasing, particularly in the dairy cows of imported races.

## Conclusion

In Algeria, there exists only few or not of relative data to the pathologies of the dairy bovine livestock. Besides, the veterinary presence is often insufficient to assure the control and follow up of the evolution of the disease on the field.

This study permitted the estimation of the prevalence of some disease and trouble of health of the dairy raisings. It takes into cognizance the prevalence of 15.11% for the clinical form and 29.77% for the sub-clinical form. The mastitis takes care of the first rank of these pathologies all along the year and especially in the spring where one also notes a strong percentage of reproductive (14.88%) and digestive trouble (11.11%).

In winter with respective 21.77 and 18.22%, the digestive and locomotive trouble comes rightly after the mastitis.

The parasitosis presents with constant rates in the farms of study, reaches a peak of 21.55% in summer with a lightning piroplasmosis blaze for the dairy cows.

The brucellosis and the tuberculosis of which the impact on the public health is very important are frequently detected in the dairy bovine raisings and the raised rates of infection in our study are already more important than those reported.

In light of these seasonal prevalences of the different pathologies of the dairy cows, a double objective proves to be indispensable:

In short-term it is primordial to put an adequate prevention program that should consist of a regular detection of these disease in place, to the reform of the subject brucellosis and tuberculosis with measures of accompaniment (compensation, etc.) and especially, to lead a big campaign of sensitization and information to all actors.

In long-term, the profession should mobilize itself in order to institute a good conduct of the herd progressively while minimizing the risks of disease that can touch the animals.

This good conduct necessarily passes by a correct food adapted to the imperatives of the new fashions of production, hygiene of life of the healthy herd and a permanent and efficient veterinary control.

## REFERENCES

- Acha PN, Szyfres B (1989). Zoonoses and communicable diseases common to humans and animals, OIE p. 1063.
- Aggad H (2002). Epidemiological Situation Of Some Zoonoses In Algeria". 10th Sci.Cong. Fac. Vet. Med. Assiut Univ. Egypt pp. 110–116.
- Aggad H (1987). Malta fever seroprevalence at Tiaret (Western Algeria). Assiut. Vet. Med. J. pp. 130–139.
- Akakpo AJ (1987) Animal brucellosis in tropical Africa. Features epidemiological, clinical and bactériologiques. Rev. Elev. Med. Vet. Pays. Trop. 40(4): 307-320.
- Alton G, Jones LM, Angus RD, Verger JM (1988). Laboratory Techniques In Brucellosis. INRA Publications. Paris.
- Bazin S (1983). Contribution to a better approach to problems of mastitis. 2nd part: Incidence and bacteriology of clinical cases. Arguments prevention plan. Bull. (1983) Soc. Vet .Prat. Fr. 67: 159-180.
- Bendixen PH, Wilson B, Ekesbo I, Astrand DB (1988). Diseases Frequencies In Dairy Cows In Sweden. V. Mastitis. Prev. Vet. Med. 5: 263-274.
- Benet J (1996). Tuberculosis. ENVN, Nantes pp. 3-111.
- Benkirane A (1998). Bovine Tuberculosis In Africa. World. Anim. Rev. 90: 54-56.
- Bouattour A (1996). Study of cattle ticks in the region Sid Thabet: their role in the transmission of theileriosis. postgraduate diploma in ecology animale. Faculty of Sciences, Tunisia.
- Bouaziz O, Aimeur R, Kabouia R, Brerhi EH, Smati F, Tainturier D (2000). Survey of bovine mastitis in the region of Constantine. 4th International Seminar of Veterinary Medicine.
- Boudilmi B, Benhabyles N (1991). Epidemiology of brucellosis animal and human situation in the Maghreb's countries. Sem. Int. Malte pp. 1-15.
- Chaloux A, Ranney AF (1974). Bacterial diseases. Tuberculosis. In W. Gibbons J. Med. Surg. Cattle. Vigot brothers Editeurs pp. 183-189.
- Dego OK, Tareke F (2003). Bovine Mastitis In Selected Areas Of Southern Ethiopia. Trop. Anim. Health. Prod. (3): 197–205.
- Desrochers A (2005). Lameness or when the reproduction box. The Quebec milk producer p. 14.
- Dib L (2005). Study spatiotemporal ticks of cattle in north-eastern Algeria. Magister thesis in veterinary science. El Tarf University Center p. 245.
- Dohoo IR, Martin SW, Macmilan I, Kennedy BW (1984). Diseases, Production And Culling In Holstein Friesian Cows.2.Age, Season And Sire Effects. Prev. Vet. Med. 2: 656-670.
- Elbers ARW, Miltenberg JD, DE Lang D, Crauwels AP, Barkema RW, Schukken YH (1998). Risk Factors For Clinical Mastitis In A Random Samples Of Dairy Herds From The Southern Part Of The Netherlands. J. Dairy Sci. 81: 420-426.
- EL Sanousi SM, Omer EE (1985). Serological Survey Of Brucellosis In Benghazi Cow Project (Libya). Int. J. Zoonoses 12: 207–210.
- Erskine RJ, Eberhart RJ, Hutchinson LJ, Spencer SB, Campell MA (1988). Incidence And Types Of Clinical Mastitis In Dairy Herds With High And Low Somatic Cell Counts. J. Am. Vet. Med. Assoc. 192: 761-765.
- Esselmont RJ (1990). In Proceedings, Vith International Symposium On Diseases Of The Ruminant Digit, Liverpool pp. 237-251.
- Faye B, Landais E, Coulon JB, Lescourret F (1994). Impact of the sanitary trouble among the dairy cow: evaluation of the 20 years of observations in 03 experimental herds. INRA Prod. Anim. 7(3): 191-206.
- Fikria A (2004). Tuberculose Bovine Au Maroc. In The 2nd International Conference On Animal Tuberculosis In Biotechnol. Agron. Soc. Environ. 8(1): 3–8.
- Fontaine M (1987). Vade-Mecum Du Veterinaire.15e Edition. 1642 Pages, Vigot Frères Editeurs, , Paris.
- Fourichon C (2001). Assessment of the zootechnic and economic impact of the health trouble in dairy bovine raising. National Superior Agronomique school, Rennes p. 252.
- Fourichon C, Seegers H, Bareille N, Beaudeau F (2001). Assessment of the losses and the economic impact consecutive to the main unrests of health in dairy bovine raising. Meetings Research Ruminants. Paris 8: 137-143.
- Giannechini R, Conncha C, Rivero R, Deluci I, Moreno LJ (2002). Occurrence Of Clinical And Sub Clinical Mastitis In Dairy Herds In The West Littoral Region In Uruguay. Act. Vet. Scand. 43(4): 221-230.
- Haddad S (2001). The supply of Tunis in milk flow identification and policy actors in the sector. Thesis of Master of Science. Agronomic Mediterranean Institut of Montpellier p. 136.
- Heleili N (2002). study of subclinical mastitis and the *in vitro* sensitivity of the germs isolated to the antibiotics. Thesis of magister. Batna University. Algeria p. 202.
- Koutchoukali MA (2000). The Bovine mastitis in the Daïra of Constantine. Detection and bacteriology. Veterinary doctorateThesis., University of Constantine p. 41.

- Kossabati MA, Esslemont RJ (1997). The Costs Of Production Diseased In Dairy Herds In England. *Vet. J.* 54(1): 41-51.
- Lazar P, Schwartz D (1987). In : *Elements De Probabilites Et Statistiques*, 4eme Ed. Paris, France, Flammarion p. 163.
- Mouchet C, Denis B, Drouin B (1986). *Les Frais Veterinaires En Elevage Bovin Laitier. Recueil De Medecine Veterinaire.* Avril pp. 485-493.
- Morgan WJB, Mackinnon DJ, Lawson JR, Cullen GA (1969). The Rose Bengale Plate Ag. Test In The Diagnostic Of Brucellosis. *Vet. Rec.* pp. 636-641.
- Morse D, De Lorenzo MA, Wilcox CJ, Natzke RP, Bray DR (1987). Occurrence And Reoccurrence Of Clinical Mastitis. *J. Dairy Sci.* 70: 2168.
- Miller GY, Dorn CR (1990). Costs Of Dairy Cattle Diseases To Producers In Ohio. *Prev. Vet. Med.* 8(2-3): 171-182.
- Niar A, Ghazy K, Dahache SY (2000). Incidence of the mastitis on the different bovine raisings in Tiaret. 4th International Seminary of Veterinary Medicine. Constantine. Nov 21th-22th.
- Peeler EJ, Green MJ, Fitzpatrick JLP, Green LE (2002). Study Of Clinical Mastitis In British Dairy Herds Bulk Milk Somatic Cell Counts Less Than 150 000 Cells/Ml. *Vet. Record* 151: 170-176.
- Pieters T (1989). The loads of health of the specialized dairy exploitations. Sustained memory in seen of the obtaining of the diploma of certificate of first year end has the superior institute of the animal productions: Nantes p. 76.
- Rahmouni Al, Mazouz A (2003). *Etude Des Protocoles De Traitement Des Mammites Bovines Au Maroc (Enquêtes De Terrain)*. Xxeme Congrès Veterinaire Maghrebin, 8 Et 9 Mai, Fès Maroc.
- Refai M (2002). Incidence And Control Of Brucellosis In The Near East Region. *Veterinary Microbiology Special Issue Of Brucellosis* 90(1-4): 604.
- Rouina AD (1983). *Etude Clinique De Theileriose Bovine Sur 327 Cas En Algerie, (Region Nord -Ouest / Mascara)*. Maghreb . *Vet.* 1: 3 Decembre- Janvier 1984.
- Ruegg PL, Reiman DJ (2002). Milk Quality And Mastitis Test. *The Bovine Practitioner* 36(1): 41-54.
- Sargeant JM, Morgan A, Scott H, Leslie KE, Ireland MJ, Bashiri A. (1998). Clinical Mastitis In Dairy Cattle In Ontario: Frequency Of Occurrence And Bacteriological Isolates. *Can. Vet. J.* 39: 33-38.
- Saxena RK, Dutttag N, Borah R, Duragohain J (1993). Incidence And Etiology Of Bovine Subclinical Mastitis. *India. Vet. J.* 70: 1079-1080.
- Schalm OW, Carrol EJ, Jain C (1971). *Bovine Mastitis*. Philadelphia, Pa, Usa: Lea And Febriger pp. 94-157.
- Schalm OW, Noorlander DO (1957). Experiments And Observations Leading To Development Of The California Mastitis Test. *J. A. V. M. A.* 130: 199-204.
- Seegers H, Menard JL, Fourichon C (1997). Mastitises in dairy bovine raising: present importance, epidemiology and plan of prevention. *Ren. Rec. Ruminants* 4: 233-242.
- Seegers H, Fourichon C, Beaubeau F, Bareille N, Malher X (2002). To value the impact economic of the balance of health and the profitability waited of actions of health mastery in dairy herd. *National Days SNGTV*, May 29-31, Tours pp. 247-251.
- Sischo WM, Hird GIA, Utterback WW, Christiansen KH, Carpenter TE, Danaye-Elmi CA, Heron BR (1990). *Economics Of Disease Occurrence And Prevention On California Dairy Farms: A Report And Evaluation Of Data Collected From The National Animal Health Monitoring System.* 1986-19 87. *Prev. Vet. Med.* 8(2-3): 141-156.
- Tisserand JL, Fevrier R (1989). Analysis compared of the effect of the dairy Policies on the structures of production and collection in the countries of Maghreb. *Options Mediterranean, series A.* 6: 123-358.
- Traore A, Tamboura H, Bayala B, Rouamba DW, Yameogo N, Sanou M (2004). Global prevalence of the major pathologies bound intra to the bovine dairy production in system of raising urban in Hamdallaye (Ouagadougou). *Biotechnol. Agron. Soc.* 8(1): 3-8.
- Waage S (1998). Identification Of Risk Factors For Clinical Mastitis In Dairy Heifers. *J. Dairy Sci.* 81: 1276-1284.
- Wilesmith JW, Francis PG, Wilson CD (1986). Incidence Of Clinical Mastitis In A Cohort Of British Dairy Herds. *Vet. Record* 118: 199-204.