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*Recent epidemiological data on lumpy skin disease in
Northern Algeria*

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Dedication

All praise is due to Allah, by whose grace good deeds are completed and by whose favor goals are achieved. With His guidance, I have successfully reached the culmination of this stage in my life.

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This success is as much yours as it is mine.

From the depths of my heart, thank you

Abstract

Lumpy Skin Disease (LSD) is an arthropod-borne viral disease primarily affecting cattle and other ruminants. It causes significant economic losses due to reduced feed intake, decreased milk production, impaired weight gain, abortion, infertility, hide damage, secondary infections, and mortality.

Algeria was officially LSD-free until June 2024, when the first case was diagnosed in Blida province on June 18th.

To explore the main factors involved in the spread of this disease, a survey was undertaken from June to November 2024 on 120 cattle farms in three northern provinces—namely Blida, Tizi Ouzou, and Bejaia—through farm visits and face-to-face questionnaires.

According to veterinarians working in Blida, the mortality rate exceeds 10%, while morbidity exceeds 20%. The first case was diagnosed and reported on June 18, 2024.

In the Tizi Ouzou department, the mortality rate was approximately 7%. In Bejaia province, 10% of the visited farms were affected, with a mortality rate below 5%.

The three most influential factors appear to be the poor condition of livestock buildings, inadequate hygiene, and animal stress—specifically, the proximity to industrial plants.

Keywords: Cattle, Lumpy skin disease, three northern provinces, Risk Factors, Cattle Productivity and Algeria.

Résumé

La dermatose nodulaire contagieuse bovine est une maladie virale transmise par les arthropodes, affectant principalement les bovins et autres ruminants. Cette maladie virale dévastatrice engendre des pertes économiques considérables dans l'industrie bovine, liées à la diminution de la consommation alimentaire, à la baisse de la production laitière, à une moindre conversion pondérale, ainsi qu'à d'autres séquelles directes et/ou prolongées, notamment l'avortement et l'infertilité, les dommages aux peaux des bovins, les infections bactériennes secondaires, et la mortalité.

Jusqu'en juin 2024, l'Algérie était exempte de la dermatose nodulaire contagieuse (LSD) ; cependant, plusieurs foyers ont été soudainement signalés dans le pays, principalement dans la province de Blida.

Pour explorer les principaux facteurs impliqués dans la propagation de cette maladie, une enquête a été menée de juin à novembre 2024 auprès de 120 élevages bovins dans trois provinces du Nord, à savoir Blida, Tizi Ouzou et Bejaia, par des visites sur site et des questionnaires en face à face.

Selon certains vétérinaires exerçant à Blida, le taux de mortalité dépasse 10 %, tandis que la morbidité est supérieure à 20 %. Le premier cas a été diagnostiqué et déclaré le 18 juin 2024. Dans le département de Tizi Ouzou, le taux de mortalité était d'environ 7 %.

Dans la province de Bejaia, 10 % des exploitations visitées ont été touchées, avec un taux de mortalité inférieur à 5 %. Les trois facteurs les plus influents semblent être le mauvais état des bâtiments d'élevage, les conditions d'hygiène insuffisantes et le stress animal, en particulier la proximité des zones industrielles.

Mots clés : Bovins, Dermatose nodulaire contagieuse, trois provinces du Nord, facteurs de risque, productivité bovine, Algérie.

ملخص

مرض الجلد العقدي البقري هو مرض فيروسي ينتقل عن طريق المفصلية ويؤثر بشكل رئيسي على الماشية والحيوانات المجترة الأخرى. هذا المرض الفيروسي المدمر مسؤول عن خسائر اقتصادية كبيرة للغاية في صناعة لحوم البقر تتعلق بانخفاض استهلاك الغذاء وانخفاض إنتاج الحليب وتحويل الوزن، فضلاً عن المضاعفات المباشرة و/أو المطولة الأخرى، بما في ذلك الإجهاض والعقم وتلف جلود الماشية والالتهابات البكتيرية الثانوية والوفيات.

حتى يونيو 2024، كانت الجزائر خالية من عقار إل إس دي، ولكن تم الإبلاغ فجأة عن العديد من حالات تفشي المرض في البلاد، خاصة في محافظة البليدة.

ولاستكشاف العوامل الرئيسية المتورطة في انتشار هذا المرض، تم إجراء مسح من يونيو إلى نوفمبر 2024 بين 120 مزرعة ماشية في ثلاثة (3) محافظات شمالية، وهي البليدة وتيزي وزو وبجاية، من خلال زيارة المزارع والاستبيان وجهاً لوجه.

وبحسب بعض الأطباء البيطريين الممارسين في البليدة، فإن معدل الوفيات يتجاوز 10% بينما تجاوزت نسبة الإصابة بالمرض 20%، وتم تشخيص الحالة الأولى والإبلاغ عنها في 18 يونيو 2024. وفي مقاطعة تيزي وزو، بلغ معدل الوفيات حوالي 7%. وفي محافظة بجاية، تأثرت 10% من المزارع التي تمت زيارتها، وبلغ معدل الوفيات أقل من 5%. ويبدو أن العوامل الثلاثة الأكثر تأثيراً هي الحالة السيئة لمباني الماشية، وسوء ظروف النظافة، والإجهاد الحيواني، وتحديداً القرب من المناطق الصناعية.

الكلمات المفتاحية: الأبقار، مرض الجلد العقدي. ثلاثة محافظات شمالية، عوامل الخطر، إنتاجية الأبقار، الجزائر.

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ABBREVIATIONS

CI	Confidence Interval
CFSPH	Center for Food Security and Public Health
CO ₂	Carbondioxide
Cpx	Capri pox
CSA	Central Statistical Authority
DF	Dilution fluid
DNA	Deoxyribonucleic acid
dsDNA	Double stranded Deoxyribonucleic Acid
DVM	Doctor of Veterinary Medicine
ELISA	Enzyme-linked immunosorbent assay
FAO	Food and Agricultural Organization
FCS	Fetal Calf Serum
FITC	Fluorescein Isothiocyanate
FVM	Faculty of Veterinary Medicine
GDP	Gross Domestic Product
GTPV	Goat pox virus
HF	Holstein Friesian
IFAT	Indirect fluorescent antibody test
IgG	Immuno gamma-globulin
ILRAD	International Laboratory for Research on Animal Disease
KM ²	Square kilometers
KS-1	Kenyan Sheep 1 virus
LSD	Lumpy skin disease
LSDV	Lumpy skin disease virus
M	Mole
m.a.s.l.	Meter above Sea Level
MEM	Minimum Essential Medium eagle
ml	Mililiter
OIE	Office International des Epizooties, World Animal Health

OR	Odd Ratio
PBS	Phosphate-Buffered Saline
PCR	Polymerase Chain Reaction
PCV	Packed Cell Volume
PH	Power of Hydrogen
PPR	Peste des petits ruminants disease
RR	Risk Ratio
SGPV	Sheep and goat pox virus
SPPV	Sheep pox virus
USD	United State' s Dollar
UV	Ultra Violet
WHO	World Health Organization
μl	Microliter

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General introduction

Lumpy skin disease (LSD) is a viral disease affecting cattle and water buffalo, with significant economic repercussions. It leads to substantial losses in dairy, meat, and hide production, thereby impacting food security, livelihoods, and trade.

The disease poses a global challenge that requires coordinated efforts among national, regional, and international authorities and organizations to enhance awareness, preparedness, advocacy, and resource allocation for effective control.

The primary risk factors contributing to the spread of LSD include the introduction of the virus into naïve cattle populations, high cattle density, and the abundance of vectors.

The cattle may be unvaccinated, vaccination coverage insufficient, or low-quality vaccines with limited efficacy may have been used; additionally, vaccination records are often incomplete or lacking. It is also common that when vaccination against LSD ceases to be mandatory, vaccination rates decline sharply, leading to an increase in susceptible populations and a heightened risk of new outbreaks.

Additionally, animal movements, the use of vaccines with low quality and efficacy, and limited awareness about the disease—including its clinical signs, mitigation measures, and impacts—contribute significantly to its spread. Delayed reporting of outbreaks further increases the risk of transmission. Addressing these challenges through coordinated efforts is essential for the effective management and control of LSD.

With the introduction of LSD into Libya in 2023 (notified to WOAH on 8 April 2023) and its subsequent spread to Algeria (as reported by the Ministry of Agriculture's national veterinary service through alerts to farmers via social media and national mass media coverage from June to July 2024), there is an increasing risk of the virus spreading to **Tunisia, Morocco, Mauritania**, and eventually to European countries—primarily **Spain** and **Portugal**—as well as other nations on the European continent.

Lumpy Skin Disease (LSD) can be considered endemic in many countries of the Near East region. Since its introduction, it has emerged as an epizootic disease and was reported in Egypt (1988–1989, 2006, 2011, and 2014), Palestine (1989, 2006, 2007, 2012, 2019, 2020, and more recently in 2023), Jordan, Lebanon, Syria, and Iraq (2012–2014), as well as in the Gulf Cooperation Council (GCC) countries.

It is this situation that prompted us to undertake this study. The primary objectives of this work are to investigate the epidemiology of this vector-borne disease, first introduced in Algeria in June 2024, to identify the various factors influencing its distribution, and to examine the available control measures.

This dissertation is divided into two parts. The first part addresses the causative agent and its vectors, epidemiology, clinical features, diagnosis, and control methods. The second part is experimental and compiles all the epidemiological data necessary to analyse the disease's distribution, investigate the contributing factors, and ultimately develop a control plan.

Review of Literature

1.1. The Causative Organism

Lumpy skin disease is caused by the Lumpy Skin Disease Virus, a member of the Capripoxvirus genus. These viruses are enveloped, brick-shaped particles with complex symmetry, measuring approximately $300 \times 270 \times 200$ nm (Shakya, 2001). Mature capripoxvirions exhibit a more oval profile and possess larger lateral bodies compared to orthopoxvirions (Abdulqa et al., 2016).

These viruses are generally resistant to desiccation, can survive freezing and thawing cycles, and remain viable for months in a lyophilized state. However, their sensitivity to heat varies among different strains (Rao and Bandyopadhyay, 2000).

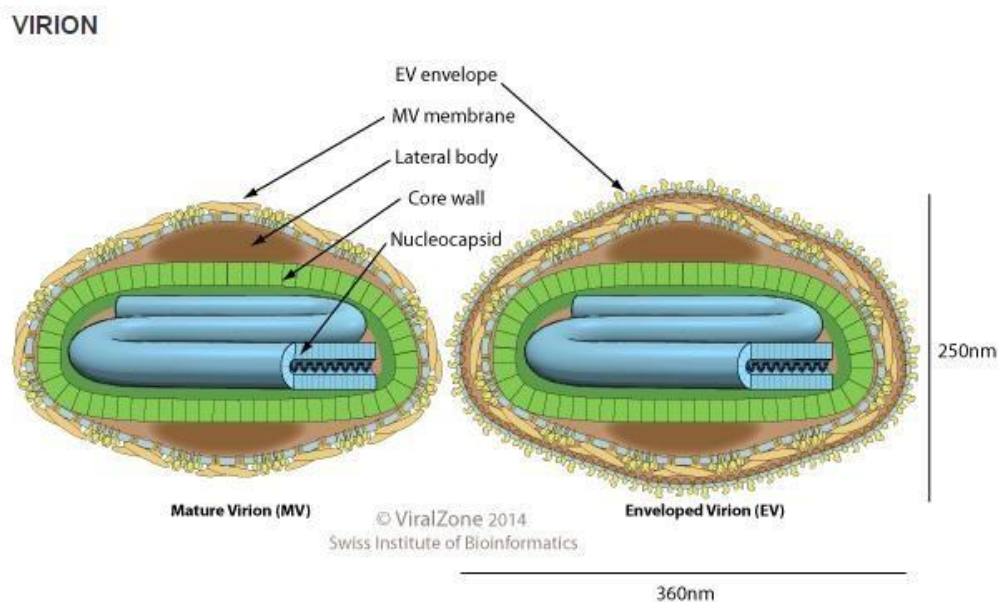


Figure 1. Capripoxvirus structure. Source: ViralZone, 2014.

CaPVs are double-stranded DNA viruses with genomes approximately 150 kbp in size. LSDV shares a close genetic relationship with SPPV and GTPV (Gelaye et al., 2015), but contains nine additional genes that are non-functional in SPPV and GTPV. Some of these genes are likely responsible for LSDV's ability to specifically infect cattle (Tulman et al., 2001).

CaPV isolates are highly conserved, exhibiting genome identities of at least 96% among SPPV, GTPV, and LSDV (Tulman et al., 2001; Babiuk et al., 2008).

The LSDV genome consists of a central coding region flanked by identical 2.4 kbp inverted terminal repeats and contains 156 putative genes. LSDV genes exhibit a high degree of colinearity and an average amino acid identity of 65% in their genomic regions when compared with genes of other known mammalian poxviruses, such as suipoxvirus, yatapoxvirus, and leporipoxviruses (Madhavan et al., 2016; Tulman et al., 2001).

Although CaPVs share a high nucleotide sequence identity, they are phylogenetically distinct. Phylogenetic analysis has shown that members of the genus can be delineated into three distinct clusters—GTPV, SPPV, and LSDV—based on the P32 genomic sequence. Notably, an additional aspartic acid at the 55th position of the P32 protein is present in sheep poxvirus but absent in GTPV and LSDV (Hosamani et al., 2004).

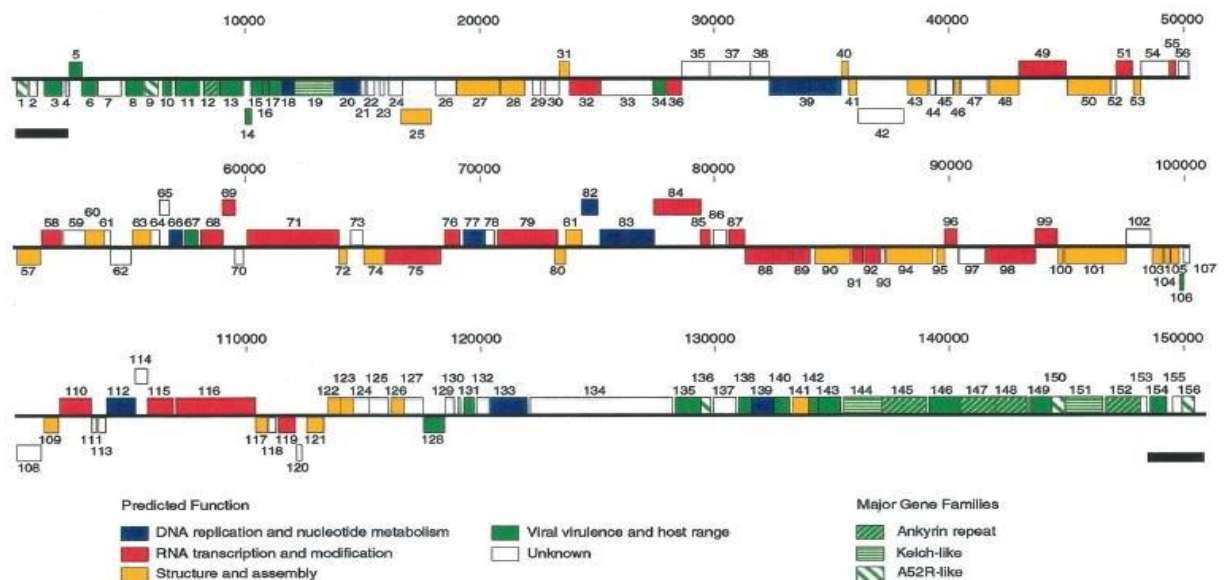


figure (2): Linear map of the LSDV genome (Source: Tulman et al., 2001)

1.2. History of Lumpy Skin Disease

Lumpy skin disease was first described in Zambia in 1929, initially believed to be caused by poisoning or a hypersensitivity reaction to insect bites due to its clinical presentation. The disease subsequently spread to other African countries, including Botswana (formerly Bechuanaland), Zimbabwe (formerly Southern Rhodesia), and the Republic of South Africa, between 1943 and 1945.

During the subsequent decades, LSD gradually spread northwards and is now present throughout the entire African continent, including Madagascar, with a few exceptions such as Libya, Algeria, Morocco, and Tunisia (Abdulqa et al., 2016; Tuppurainen and Oura, 2011).

In East Africa, LSD was first identified in Kenya in 1957 and in Sudan in 1972 (Ali and Obeid, 1977), while it spread to West Africa in 1974 and to Somalia in 1983. The first LSD outbreak in Egypt was reported in May 1988.

In Ethiopia, the disease was observed between 1981 and 1983 in the northwestern, western, and central regions, with considerable morbidity and mortality rates (Mebratu et al., 1984).

Lumpy skin disease was initially confined to the African continent until 1989, after which it spread beyond Africa to Madagascar and the Middle East, causing significant economic losses in livestock production. Prior to 2012, only sporadic outbreaks of LSDV were reported in the Middle East region (Tuppurainen and Oura, 2011).

With the recent introduction of lumpy skin disease into Libya in 2023 (notified to WOA on 8 April 2023) and its subsequent spread to Algeria (as reported by the Ministry of Agriculture's national veterinary service through alerts to farmers via social media and national mass media coverage between June and July 2024), there is an increasing risk of the virus spreading to Tunisia, Morocco, Mauritania, and eventually to European countries—primarily Spain and Portugal—as well as other nations across the European continent.

Lumpy skin disease (LSD) can be considered endemic in many countries of the Near East region. Following its introduction, it has emerged as an epizootic disease, with reported outbreaks in Egypt (1988–1989, 2006, 2011, and 2014), Palestine (1989, 2006, 2007, 2012, 2019, 2020, and more recently in 2023), as well as in Jordan, Lebanon, Syria, and Iraq (2012–2014).

The Gulf Cooperation Council (GCC) states—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates—as well as Yemen, share borders with LSD-endemic countries such as Jordan and Iraq, placing them at constant risk of LSD introduction through live animal imports, including from these endemic regions. In the past, GCC states have also reported sporadic cases of LSD (FAO, 2024).

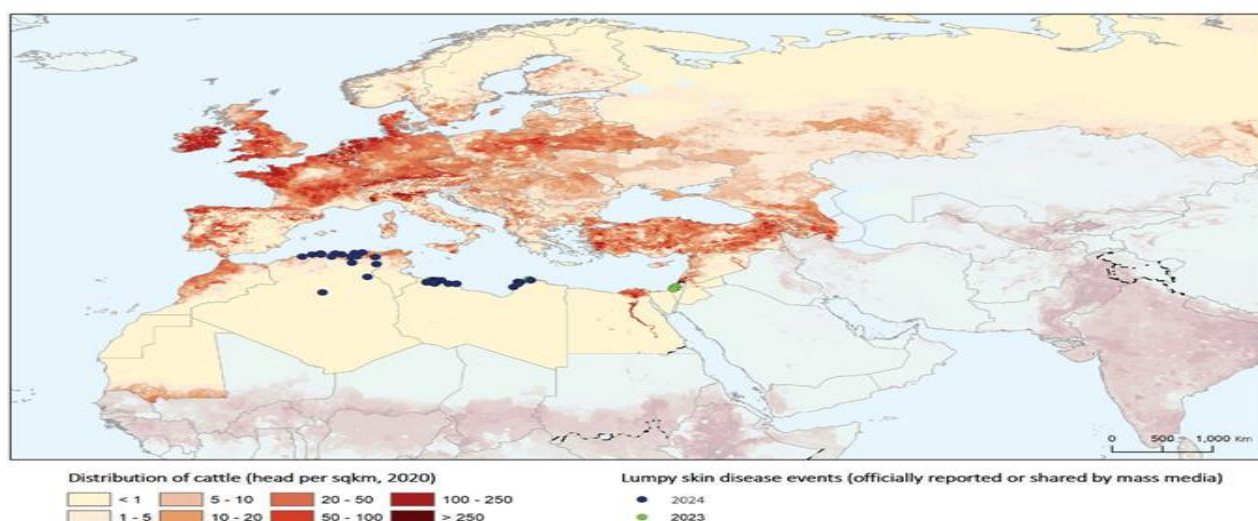


Figure 3: Spread of LSD in the Middle East and North Africa

Source: UN Geospatial, 2020. Map of the World. United Nations. Accessed July 2024.

<https://www.un.org/geospatial/file/3420/download?token=TUP4yDmF>

Modified with GLW4 2020 and FAO EMPRES-i data (FAO, 2024).

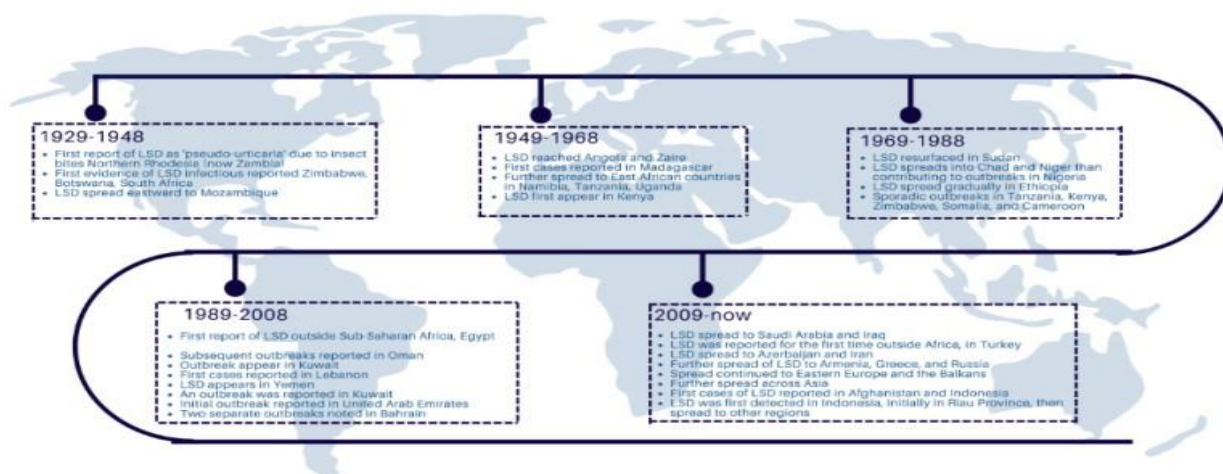


Figure 4: Historical timeline of key events in lumpy skin disease (LSD) from 1929 to present (Hidayatik et al., 2025).

1.3. Epidemiology

1.3.1. Occurrence of the Disease

Lumpy skin disease (LSD) is endemic in most African countries, particularly those in the sub-Saharan region.

Since 2012, it has rapidly spread across the Middle East, southeastern Europe, the Balkans, the Caucasus, Russia, and Kazakhstan (OIE, 2017; Coetzer and Tuppurainen, 2004).

Field outbreaks of LSD can vary widely in severity. In many cases, infections are severe and generalized, resulting in high morbidity and mortality rates. However, some outbreaks affect only a few animals, with minimal or no recorded deaths. Generally, outbreaks tend to be more severe upon the initial introduction of the infection to a region, then gradually decrease in intensity, likely due to the development of widespread immunity within the population.

Morbidity rates may reach up to 80% during epizootics, whereas in endemic areas, they typically approximate 20% (Radostits et al., 2006).

1.3.2. Susceptible Animals

Domestic cattle and Asian water buffalo are the primary species naturally affected by LSDV during field outbreaks (El-Nahas et al., 2011; Al-Salihi, 2014). Although some viral strains may replicate in sheep and goats, no epidemiological studies to date have confirmed small ruminants as reservoirs for the virus (Tuppurainen, 2017).

Very little is known about the susceptibility of wild ruminants to LSDV. The susceptibility of host animals largely depends on factors such as immune status, age, and breed rather than on the virulence of the virus itself. European cattle breeds are generally more susceptible than indigenous African and Asian breeds (Tageldin et al., 2014).

1.3.3. Sources of the Virus and Transmission

Capripoxviruses exhibit high resistance to both physical and chemical inactivation. They can remain viable in scabs or tissue fragments for extended periods (Davies, 1991). Lumpy skin disease virus (LSDV) has been successfully recovered from skin nodules stored at -80°C for up to ten years and from infected tissue culture fluid maintained at 4°C for approximately six months (Coetzer and Tuppurainen, 2004).

Furthermore, LSDV can be isolated for up to 35 days or more from skin nodules, scabs, and crusts, which are known to harbor relatively high concentrations of the virus.

LSDV can also be isolated from the blood, saliva, ocular and nasal discharges of infected animals (Weiss, 1968), as well as from semen (Irons et al., 2005). The virus appears intermittently in the bloodstream between approximately 7- and 21-days post-infection, though at lower concentrations compared to those found in skin nodules.

Notably, viral shedding in semen can be prolonged; LSDV has been isolated from the semen of an experimentally infected bull up to 42 days post-infection (OIE, 2017).

Studies have demonstrated that the primary mode of transmission of lumpy skin disease (LSD) is via arthropod vectors, whereas direct contact between animals is considered an inefficient route (Magori-Cohen et al., 2012). Several vector species have been implicated in the spread of LSD, including biting flies such as *Stomoxys calcitrans*, *Musca domestica*, and *Aedes aegypti* mosquitoes. Additionally, three common African hard tick species—*Rhipicephalus appendiculatus*, *Amblyomma hebraeum*, and *Rhipicephalus (Boophilus) decoloratus*—have been reported to play significant roles in the transmission of the virus (Chihota et al., 2001; Chihota et al., 2003; Yeruham et al., 1995).

Studies have demonstrated that *Aedes aegypti* mosquitoes can transmit lumpy skin disease virus (LSDV) to susceptible animals without necessarily causing the development of clinical disease in the hosts (Chihota et al., 2001). Transstadial and transovarial transmission of LSDV has been observed in *Boophilus decoloratus* ticks, while mechanical or intrastadial transmission has been documented in *Rhipicephalus appendiculatus* and *Amblyomma hebraeum* (Tuppurainen et al., 2011).

Additionally, the use of shared drinking troughs has been identified as a potential source of infection, supporting the hypothesis that infected saliva may contribute to disease transmission. Furthermore, LSDV can be transmitted to calves through infected milk (Coetzer and Tuppurainen, 2004).

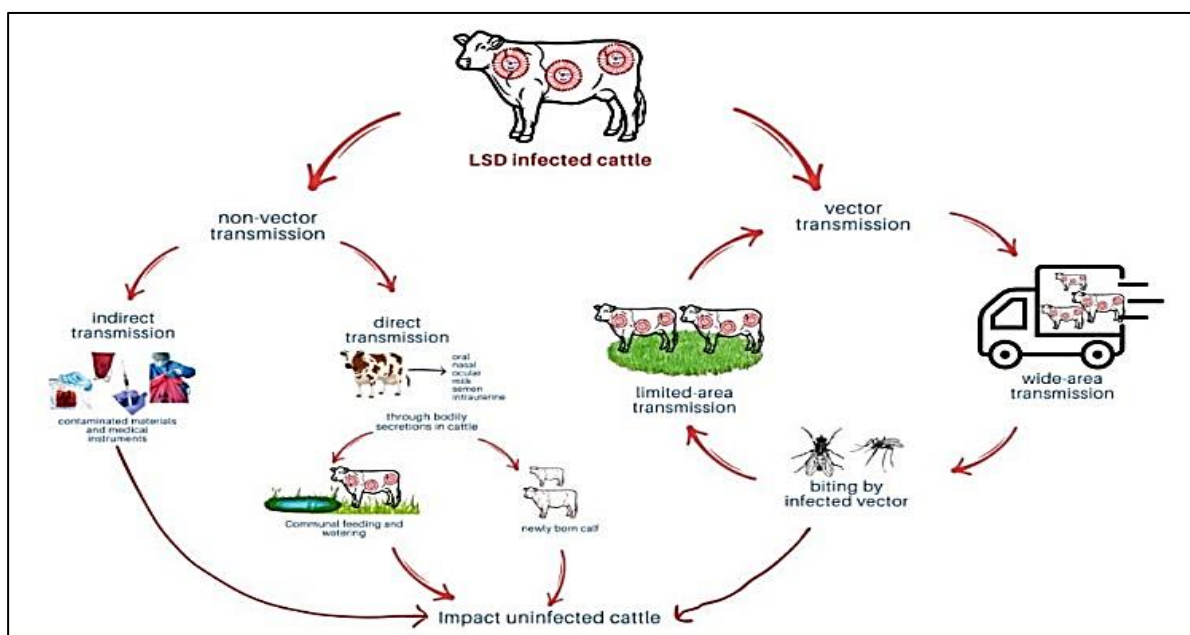


Figure 5: Schematic representation of the possible modes of transmission of the lumpy skin disease virus (LSDV).

1.4. Pathogenesis and Clinical Signs

The exact incubation period of lumpy skin disease (LSD) under field conditions has not been clearly established; however, experimental studies indicate that fever typically develops 6 to 9 days after viral inoculation. LSDV replicates within host cells such as macrophages, fibroblasts, pericytes, and endothelial cells located in the walls of blood and lymphatic vessels. This replication leads to vasculitis and lymphangitis, and in severe cases, thrombosis and infarction may also occur (Al-Salihi, 2014).

In acutely infected animals, an initial episode of pyrexia often occurs, with body temperatures exceeding 41°C, and may persist for up to one week. Superficial lymph nodes become enlarged, and cutaneous lesions typically appear between 7- and 19-days post-infection. These lesions are most commonly observed on the head, neck, udder, scrotum, vulva, and perineal region, with the earliest lesions often appearing in the perineum.

In lactating cattle, a marked reduction in milk yield is commonly observed (OIE, 2017; Radostits et al., 2006). LSD lesions are typically round, firm, and measure between 1 to 4 cm in diameter. They appear flattened, with hair standing erect over the affected areas. The number of lesions can range from a few to several hundred; they are primarily intradermal and generally confined to the skin.

Lacrimation, nasal discharge, salivation, and lameness can also be observed in association with pyrexia. Lesions may occur in the nostrils and on the turbinates, causing mucopurulent nasal discharge, respiratory obstruction, and snoring. In severe cases, plaques and ulcers in the mouth result in salivation, and nodules on the conjunctiva lead to severe lacrimation. The lymph nodes draining the affected areas become enlarged, causing local oedema (Radostits et al., 2006; Maclachlan and Dubovi, 2011).

In experimental studies, intravenous inoculation results in severe generalized infection, whereas intradermal inoculation leads to localized lesions or no apparent disease in only 40–50% of animals. Localized swelling at the inoculation site appears after four to seven days, accompanied by enlargement of the regional lymph nodes following subcutaneous or intradermal inoculation of cattle with LSDV (Al-Salihi, 2014; Abdulqa et al., 2016).

1.5. Pathology

Gross Pathological Lesions

Skin nodules are usually uniform in size, firm, spherical, and raised; however, some may coalesce to form large, irregular, and well-circumscribed plaques. When incised, the surface of the nodules appears reddish-gray, with oedema present in the subcutaneous layer.

Necrotic lesions, typically round in shape, can also be observed in various parts of the alimentary, respiratory, and urogenital tracts. Affected sites may include the muzzle, nasal cavity, larynx, trachea, bronchi, interior of the lips, dental pad, abomasum, uterus, vagina, teats, udder, and testes (Constable et al., 2017).

Hematological and Serum Biochemical Changes

Haematological and serum biochemical analyses of animals naturally and experimentally infected with LSDV have been recently studied and documented. Neamat-Allah's findings revealed a significant decrease in red blood cells, haemoglobin, packed cell volume, and mean corpuscular haemoglobin concentration, accompanied by a notable increase in mean corpuscular volume in experimentally infected animals, indicating macrocytic hypochromic anaemia.

The studies concluded that alterations in serum biochemical parameters may result from liver and kidney dysfunction, severe inflammatory responses, and disease complications such as anorexia and muscle wasting during LSDV infection (Al-Salihi, 2014).

Histopathological Findings

Histopathological findings of LSD are highly characteristic and serve as a foundation for diagnosis. The lesions vary significantly depending on the stage of disease development. In the acute stage, the disease is primarily characterized by vasculitis, thrombosis, infarction, and perivascular fibroplasia.

The infected areas show infiltration by inflammatory cells, including macrophages, lymphocytes, and eosinophils.

Keratinocytes, macrophages, endothelial cells, and pericytes may exhibit intracytoplasmic eosinophilic inclusions. The epidermis and dermis of the infected animal show oedema and infiltration by large epithelioid macrophage-type cells.

There is oedema and infiltration of the epidermis and dermis with large epithelioid macrophage-type cells, which have also been well described in sheep pox.

These cells are found alongside plasma cells and lymphocytes in early lesions. In older lesions, fibroblasts and polymorphonuclear leukocytes, along with some red blood cells, predominate.

Endothelial proliferation is observed in the blood vessels of the dermis and subcutis, accompanied by lymphocytic cuffing of the vessels, which leads to thrombosis and necrosis. Specific intracytoplasmic inclusions may be found in various epithelial elements, sebaceous glands, and follicular epithelium. These inclusions are predominantly eosinophilic-purple and appear surrounded by a clear halo, likely a processing artifact.

The lesions are substantially similar throughout the body (Burdin, 1959; Ali et al., 1990; El-Neweshy et al., 2012; Ali and Amina, 2013).

1.6. Diagnosis

There are currently no commercially available diagnostic test kits for the direct detection of Lumpy Skin Disease Virus (LSDV). Therefore, the tentative diagnosis of LSD is primarily based on the observation of characteristic clinical signs and differential diagnosis. Confirmation is achieved through laboratory testing using molecular techniques such as conventional or real-time polymerase chain reaction (PCR) and virus isolation via cell culture.

Clinically, LSD should be suspected in animals presenting with characteristic skin nodules, fever, and enlargement of superficial lymph nodes (Abdulqa et al., 2016; Tuppurainen, 2017a; OIE, 2017).

1.6.1. Field Presumptive Diagnosis

A. Morbidity, Mortality, and Clinical Signs Reflecting LSD:

- Contagious disease characterized by generalized skin nodules.
- Presence of characteristic inverted conical necrosis of skin nodules (sitfast) and enlargement of lymph nodes draining the affected areas.
- Persistent fever, emaciation, and generally low mortality rates.
- Pox lesions affecting the mucous membranes of the mouth, pharynx, epiglottis, tongue, and throughout the digestive tract, as well as the mucous membranes of the nasal cavity, trachea, and lungs.
- Oedema and focal lobular atelectasis observed in the lungs.
- Pleuritis accompanied by enlargement of the mediastinal lymph nodes in severe cases.
- Synovitis and tenosynovitis with fibrin accumulation in the synovial fluid.
- Pox lesions may also be present in the testicles and urinary bladder.

1.6.2. Virus Isolation

Confirmation of LSD in a new area requires virus isolation and identification. Virus isolation is used to assess the viability of the virus in collected samples (Tuppurainen, 2017a). LSDV can be cultured in tissue cells derived from bovine, ovine, or caprine origins, with the highest yields typically obtained using lamb testis or bovine dermis cells. In cell culture, LSDV induces a characteristic cytopathic effect (CPE) and forms intracytoplasmic inclusion bodies, which are distinct from those caused by Bovine herpesvirus 2 — the agent of pseudo-lumpy skin disease that produces syncytia and intranuclear inclusion bodies in culture (Abdulqa et al., 2016; OIE, 2017).

1.6.3. Molecular detection methods

Laboratory confirmation of LSD virus can be rapidly achieved using a PCR method specific for Capripoxviruses, or by detecting characteristic Capripox virions in biopsy samples or desiccated crusts through transmission electron microscopy (TEM).

Genome detection using Capripoxvirus-specific primers targeting the attachment protein and fusion protein genes has been reported, and several conventional and real-time PCR methods have been developed for use on blood, tissue, and semen samples (Abdulqa et al., 2016; OIE, 2017; Abera et al., 2015).

Recently, a Capripoxvirus real-time PCR assay using specific primers and a probe has been validated (Bouden et al., 2009; Tuppurainen and Oura, 2011). Additionally, molecular tests employing loop-mediated isothermal amplification (LAMP) for Capripoxvirus genome detection have been reported to offer sensitivity and specificity comparable to real-time PCR, while being simpler and more cost-effective (Das et al., 2012; Murray et al., 2013).

1.6.4. Serology

Serological tests used for LSDV detection include indirect fluorescent antibody tests (IFAT), virus neutralization assays, enzyme-linked immunosorbent assays (ELISA), and immune blotting (Western blotting) (Abera et al., 2015).

The virus neutralization test (VNT) is currently the only validated serological test available for LSDV. The agar gel immunodiffusion test (AGID) and indirect fluorescent antibody test (IFAT) are less specific than the VNT due to cross-reactions with antibodies against other poxviruses. Western blotting, which detects the reaction between the P32 antigen of LSDV and test sera, is both sensitive and specific; however, it is difficult and expensive to perform. Although some antibody-detecting ELISAs have been developed, none are sufficiently validated to be recommended for routine use (OIE, 2017; Babuik et al., 2008).

1.7. Differential Diagnosis

Several diseases cause clinical signs similar to those of LSD. Therefore, obtaining a definitive diagnosis is crucial to implementing the most effective prevention and control measures for susceptible herds. Indeed, lumpy skin disease can be confused with the following diseases:

- Pseudo-lumpy skin disease
- Bovine hypodermosis
- Bovine viral diarrhea/mucosal disease
- Demodicosis (Demodex)
- Bovine malignant catarrhal fever (Snotsiekte)
- Rinderpest
- Besnoitiosis
- Onchocerciasis

1.8. Economic Importance

Lumpy skin disease (LSD) is an economically significant disease of cattle, causing serious financial losses due to high morbidity and chronic debilitation in infected animals. Milk production is greatly affected, especially in cows at peak lactation, where the disease leads to a sharp decline in yield. This reduction is attributed both to the high fever caused by the viral infection and to secondary bacterial mastitis, which is often predisposed by the development of lesions on the teats (Abera et al., 2015; Radostits et al., 2006).

Although mortality rates from LSD are generally low, the disease remains economically important for cattle in Africa due to prolonged productivity losses in both dairy and beef cattle. Additional impacts include reduced use of animals for traction, decreased body weight, mastitis, and severe orchitis, which can lead to temporary infertility and sometimes permanent sterility (Abera et al., 2015; OIE, 2017; Gari et al., 2011).

A study conducted in Ethiopia estimated the annual financial cost per head, combining losses from morbidity and mortality—including milk loss, beef loss, traction power loss, as well as treatment and vaccination expenses—at approximately USD 6.43 (range: 5.12–8) for local zebu cattle, and USD 58 (range: 42–73) for Holstein-Friesian (HF) or crossbred cattle (Gari et al., 2011).

Another study estimated that the average cost of a single ox dying from LSD was approximately 9,000 Ethiopian birr (ETB), equivalent to USD 477.7 (exchange rate: 1 USD = 18.84 ETB) (Ayelet et al., 2014).

In addition to the degradation in quality of skin and hides, LSD causes economic losses through reduced wool and meat quality, losses due to culling and mortalities, as well as costs associated with treatment and disease prevention. Although there are no specific antiviral treatments for LSD-infected cattle, expenses are incurred for treating secondary bacterial infections.

These treatment costs represent the money farmers spend on medication at local public veterinary clinics when they bring clinically sick animals for care (Abera et al., 2015b). Moreover, emaciation and a prolonged convalescence period can significantly reduce growth rates in beef cattle (Tuppurainen et al., 2015).

Costly control and eradication measures, such as vaccination campaigns, along with indirect costs arising from mandatory restrictions on animal movement, also result in significant financial losses at the national level (Tuppurainen and Oura, 2011; Gari et al., 2011; Abera et al., 2015b).

1.9. Treatment and Prevention

For lumpy skin disease, control measures other than vaccination are usually ineffective. Vaccination significantly reduces morbidity and the occurrence of epizootics, although it may not completely prevent the spread of the disease. In endemic countries, vaccination is considered the only economically viable method to control LSD and enhance cattle productivity (OIE, 2017; Abera et al., 2015).

Numerous live attenuated vaccines have been developed and used worldwide, while inactivated vaccines are considered less effective (Boumart et al., 2016). Live attenuated vaccines are currently available, are inexpensive, and provide good protection when sufficient herd immunity (over 80%) is maintained through annual vaccination campaigns (Tuppurainen et al., 2015).

Live vaccines can help control losses from lumpy skin disease in endemic areas. Four live attenuated strains of Capripoxviruses (CaPVs) have been used as vaccines specifically for the control of LSD (OIE, 2017; Brenner et al., 2009; Carn, 1993).

These include a strain of Kenyan sheep and goat pox virus, the Yugoslavian RM 65 sheep pox strain, the Romanian sheep pox strain, and the lumpy skin disease virus strain from South Africa (Al-Salihi, 2014). In endemic regions, vaccine failure poses a significant challenge to the effective control of LSD (Gari et al., 2015).

It has also been reported that CaPV vaccine strains produce a pronounced local reaction at the inoculation site in *Bos taurus* breeds (Davies, 1991), which some livestock owners find unacceptable. This has discouraged vaccine use, despite the fact that the consequences of an LSD outbreak are generally far more severe (OIE, 2017b).

Outbreaks can also be controlled through strict quarantine measures to prevent the introduction of infected animals into healthy herds, isolation and prohibition of animal movements, slaughtering of all sick and exposed animals (depopulation), proper disposal of carcasses by incineration, thorough cleaning and disinfection of premises, and effective insect control (Abera et al., 2015; Tuppurainen and Oura, 2011).

Materials and Methods

2. Materials and Methods

2.1. Objectives

Our current research on Lumpy skin disease is primarily focused on the epidemiological aspects of this disease, several objectives were perused, mainly:

- Exploring the main factors involved in the spread as well as the severity of this viral disease
- To know the provinces most severely infected
- To provide some technical strategies to prevent future outbreaks
- Assessing the economic significance on cattle productivity in the studied area

2.2. Region, Farms and Animals

This epidemiological investigation was undertaken in three northern Algerian provinces: Blida, Tizi Ouzou, and Bejaia.

The survey covered 120 cattle farms, with 40 farms from each province. A total of 1,426 cattle were clinically examined. Data regarding the studied farms were recorded, including location, date, husbandry system, housing conditions, and hygiene score.

2.3. Presentation of the Study Area

The three provinces investigated belong to the Tell Atlas, Bejaia and Tizi Ouzou with a humid climate and Blida with a slightly semi-arid climate (Saidani, 2016).

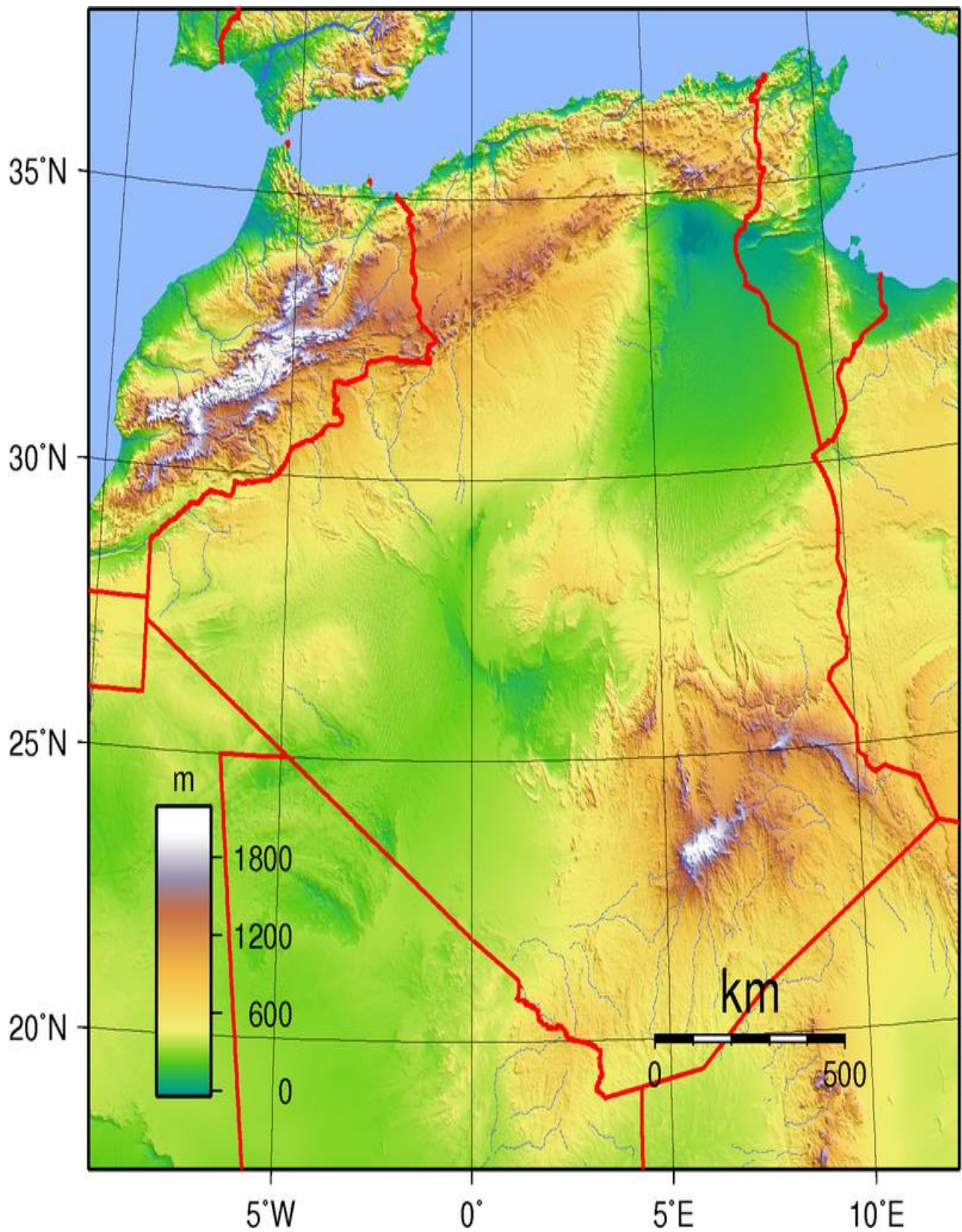


Figure 6: Map of Algeria (Central Intelligence Agency [CIA], 2020).

Indeed, the Tell Atlas, together with the Saharan Atlas located further south, forms two parallel mountain ranges that converge toward the east, with vast plains and high plateaus lying between them. These two mountain ranges tend to merge in eastern Algeria.

Towards the interior of eastern Algeria, the extensive mountain ranges of the Aurès (including Batna, Khenchela, Oum-El-Bouaghi, Aïn M'lila, Souk Ahras, Guelma, Biskra, etc.) and the Nememcha (near Tebessa) dominate the region, extending up to the Tunisian border.

The Aurès Mountains cover an area of approximately 50,000 km², with Mount Chélia reaching the highest elevation at 2,328 meters above sea level. The Tell belt, ranging from 80 to 190 km in width, stretches along nearly 1,200 km of Mediterranean coastline. It consists of several mountain ranges—including the Ouarsenis, Chenoua, Djurdjura, Babors, and Bibans—often separated by valleys rich in diverse flora and fauna. These valleys shelter important rivers such as the Chelif and Soummam. In Kabylie, Mount Lalla-Khadîdja, where snow frequently covers the peaks in winter, stands as the highest point at 2,308 meters above sea level.

The Tell plains, together with the surrounding valleys, hold the vast majority of Algeria's fertile land. Between the Tell massifs and the Saharan Atlas lies a vast expanse of plains and semi-arid high plateaus, interspersed with numerous seasonal saltwater basins known as chotts, which dry up depending on the time of year.

The lowest point in Algeria, Chott Melrhir, reaches -40 meters below sea level. This region stretches from the Moroccan border in the west to the Hodna Valley, where mountains sometimes rise to meet the Tell and Saharan Atlas ranges.

The Saharan Atlas extends from the Moroccan High Atlas to the Tunisian border, passing west to east through the massifs of Ksour, Djebel Amour, Ouled-Naïl, Zibans, and the Hodna Mountains, which connect with the Tell belt and continue into the Aurès Mountains, reaching elevations of over 2,300 meters. To the south, it is bordered by several oases, often referred to as "The gateway to the desert."

The Saharan region, which covers more than 80% of Algeria's total surface area—approximately 2 million km²—is primarily composed of regs (rocky plains), ergs (sand dunes), oases, and mountain ranges (Saidani, 2016).

Temperatures

Temperatures in the southern Sahara fluctuate dramatically between day and night, reaching up to 40°C during the day and dropping to around 5°C at night. In contrast, the northern regions experience a Mediterranean climate, characterized by hot summers.

Average temperatures in summer and winter range between 25°C and 11°C. In the northern coastal cities, winter temperatures vary from 8°C to 15°C, rising to about 25°C in May and reaching averages of 28°C to 30°C during July and August (28°C in Skikda, 29.5°C in Algiers). In the northern Kabylie mountains, winter temperatures often drop to around 3°C, and can even reach as low as -7°C. Snowfall is common there during the winter months.

The Kabylie region features several distinct climatic zones. The coastal and maritime areas experience a Mediterranean climate, with relatively mild winters averaging around 15°C and summers cooled by sea breezes, averaging about 35°C. In contrast, the higher elevations endure harsher conditions, with winter temperatures sometimes falling below zero and abundant snowfall. Summers there are very hot and dry, especially in the southern parts where rainfall is lower; however, altitude helps moderate summer temperatures in the highest areas.

On the plateaus and in the interior valleys, winters resemble those of the higher ground, while summers tend to be particularly hot due to isolation and exposure to southerly winds. For example, Medjana on the High Plateaux and Akbou in the Soummam Valley—an ideal corridor for sirocco winds—can experience high temperatures. In Tizi Ouzou city, temperatures may soar up to 46°C, compared to around 35°C in the coastal town of Dellys.

Further inland, in the Djelfa highlands (central and western Kabylie), summer temperatures range from 30°C to 38°C. Meanwhile, in the eastern Aurès region, winters are very cold, with temperatures sometimes dropping to -18°C (without considering humidex), while summers are extremely hot.

In some areas, the thermometer can reach as high as 50°C in the shade, illustrating the extreme temperature variations typical of this region. Summer temperatures generally range between 30°C and 38°C. The northwest regions—such as Oran, Tlemcen, and Mostaganem—experience a classic Mediterranean climate characterized by dry summers, mild winters, and bright, clear skies.

In contrast, the southern Sahara experiences winter temperatures ranging from 15°C to 28°C, while summer temperatures soar between 40°C and 45°C, or even higher (Saidani, 2016).

Rainfalls

The Tell region in northern Algeria experiences a Mediterranean climate, with hot, dry summers and mild, rainy winters that occasionally bring snow. This area is the wettest part of the country, receiving annual rainfall between 400 and 1,000 mm. The relatively abundant precipitation in northern Algeria has supported the growth of traditional agriculture.

A ridge line crossing the region, connecting the Blidean Atlas, the Djurdjura, the Babors, the Collo massif, and the Edough, separates a very rainy northern zone (with over 800 mm of annual precipitation) from a less watered southern zone.

This variation in rainfall has led to differences in natural vegetation density: the northern slopes, originally covered by dense forest that later gave way to orchards, contrast with the southern slopes, which were likely settled earlier and more easily due to their suitability for cultivation and livestock. In the Aures region, the average annual rainfall is around 100 mm; however, torrential rains are occasionally observed there.

The damage caused by floods can be significant, particularly in the Wilaya of Batna. In northwest Algeria, rainfall becomes scarce or even non-existent during the summer months, with skies remaining bright and clear.

The subtropical high-pressure system dominates the Oran region for nearly four months each year. However, the region still receives a significant amount of rainfall during the winter season. Characteristic of this climate are the low annual rainfall—measured at 294 mm—and the limited number of rainy days, averaging 72 days per year (Saidani, 2016).

2.4. Methodology

The collected data were recorded using Microsoft Excel spreadsheets. Descriptive statistics, such as percentages, were used to analyse morbidity, mortality, and case fatality rates. Chi-square analysis (with a p-value of 0.05 and a 95% confidence interval) was employed to determine the statistical significance of potential risk factors (Saidani, 2025).

This study was an analytical epidemiological investigation, supported by clinical observations. To facilitate data management and analysis, all information related to cattle farming was entered into an Excel spreadsheet. Each parameter was assigned a separate column, while each farm was represented by a single row in the dataset.

In parallel with the study on cattle farms, a separate Excel sheet was developed to record the individual risk factors for each examined animal.

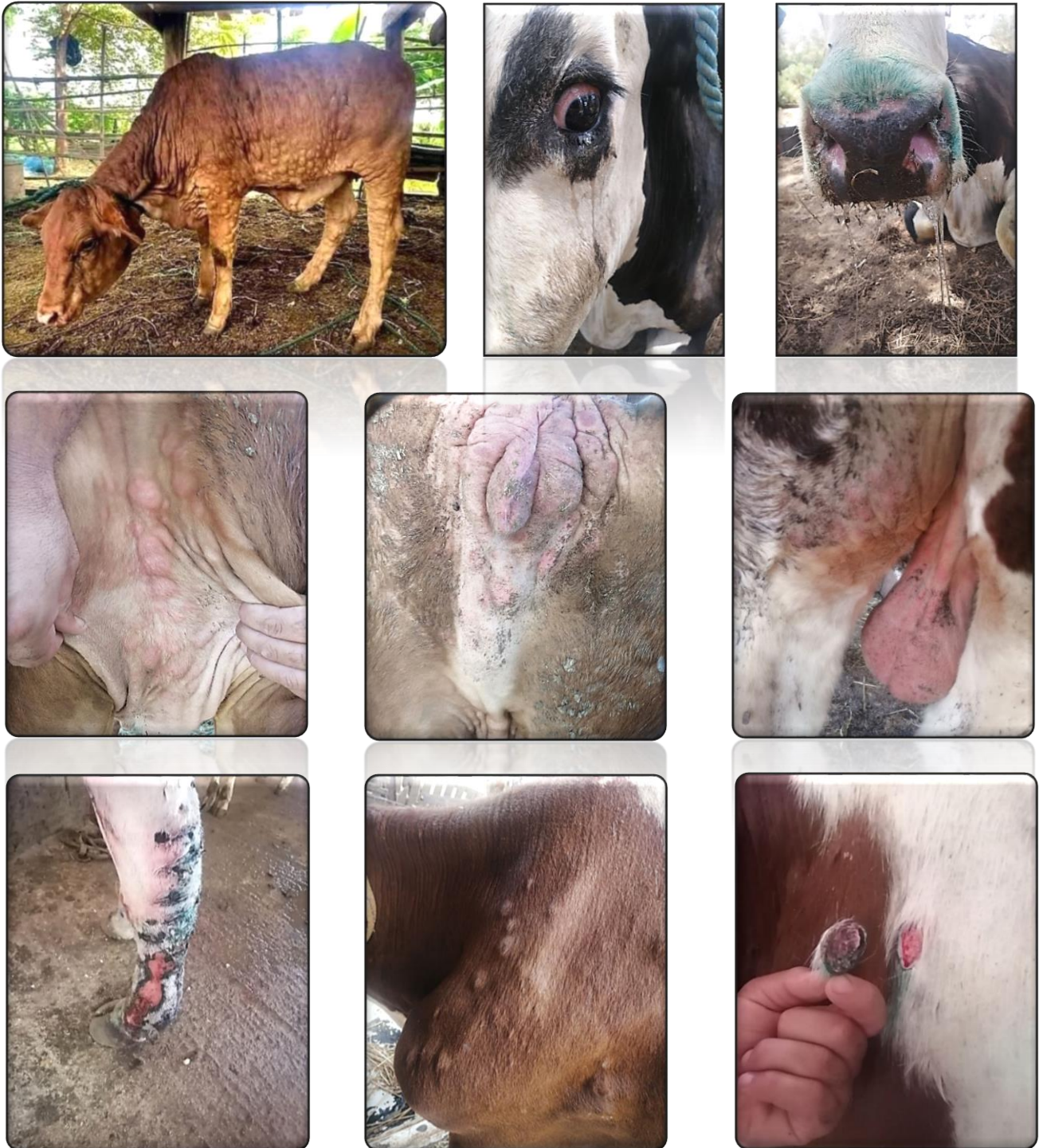


Figure 7: These photos were taken by **ALKAFARNA Abdelrahman** in September 2024 in the province of Blida for several dairy and meat cattle farms (Original, 2024).

2.5. Statistical analysis

Descriptive statistical analyses were conducted using Microsoft Excel 2016. Several variables were taken into account, including sex, age group, management system, health status, geographical area, and province.

The data were initially subjected to univariate analysis, examining each factor individually using the chi-square test. This was followed by the development of a logistic regression model to identify the most significant risk factors.

In order to assess the influence of various intrinsic factors (such as age, sex, and breed) and extrinsic factors (including management system, environment, and province) on the prevalence of lumpy skin disease, a logistic regression model was applied, following the methodology described by Saidani et al. (2024) and Saidani (2025). The dependent variable in the model was binary, representing the presence or absence of lumpy skin disease (positivity).

Statistical analyses were conducted using the latest version of the R statistical software package (version 4.4.3; R Core Team, 2025). Model selection was performed using the step function to identify the most suitable logistic regression model. The variables that were retained as the most relevant predictors included age category, preventive measures, environment, clinical examination findings, and province (department).

A p-value less than or equal to 5% was considered statistically significant.

Results and discussion

3. Results and Discussion

3.1. Characteristics of the Studied Farms and Cattle

The number of cattle across the 120 farms surveyed ranged from 1 to 133, with a total of 1,426 animals. This corresponds to an average of approximately 11 cattle per farm, and a median of nine (9) cattle.

Among the 120 cattle farms, nineteen farms (15%) were also engaged in sheep farming, while eight farms (less than 7%) were involved in goat farming.

The quality of livestock housing and overall hygiene scores were generally acceptable.

However, external parasites—such as hard ticks and dipterans—were observed on nearly all inspected farms.

The population density of arthropods—particularly dipterans, including flies and mosquitoes—was found to be strongly correlated with the hygiene score.

3.2. Prevalence of lumpy skin disease in the three provinces

The estimates of both farm-level and cattle-level prevalence (Table 1) were calculated using the same formula. The confidence interval estimate ($\alpha = 5\%$) for the prevalence of lumpy skin disease was determined using the following mathematical formula:

$$P - 1,96\sqrt{PQ/n} < p_0 < P + 1,96\sqrt{PQ/n}$$

Where: P represents the estimated proportion of the sample of n individuals (i.e., cattle) that are affected by the disease. Q denotes the proportion of cattle free from lumpy skin disease, such that $Q=1-P$.

Table 1. The overall farm-level and animal-level prevalence rates are presented

	Positive cattle farms	Negative cattle farms
Number	37	83
Percentage	31.84%	69.16%
95% confidence Intervalle	[22.57% ; 39.10%]	[60.90% ; 77.43%]
	Positive cattle	Negative
Number	193	1233
Percentage	13.54%	86.46%
95% confidence Intervalle	[11.76% ; 15.31]	[84.62% ; 88.17%]

Until recently, our country was free of the disease. However, since last June, multiple outbreaks have been reported suddenly across the country.

The first cases were reported on June 18 in the northern department of Blida (located 50 km from Algiers, the capital of Algeria), resulting in the death of at least 40 cows, according to mass media sources. A few days later, between June 24 and June 29, additional outbreaks were officially reported by the Food and Agriculture Organization (FAO) in other departments in the northern region (Tizi Ouzou, Algiers, Setif, Mila) and in the North Saharan region (Ghardaïa, El Oued) (FAO, 2024).

Subsequently, the disease was also reported in other departments, including Bejaia, Jijel, Medea, and Bouira. The most affected department was Tizi Ouzou, which reported 295 outbreaks across 33 communes, resulting in 273 deaths—a mortality rate of approximately 6.71%. Although the origin of the infection has not yet been elucidated, the concentration of most outbreaks in the eastern region suggests a possible introduction from the neighbouring country of Libya, which has reported multiple outbreaks since the virus was first introduced there in July 2023.

Notably, Tunisia reported its first case on July 31, 2024 (FAO, 2024). To control the disease, the national animal health authorities have implemented multiple sanitary preventive measures, including restrictions on animal movements, closure of animal markets in the affected departments, isolation of infected animals, and the launching of disinfection and decontamination campaigns. Subsequently, a vaccination campaign was initiated on August 19th in the most affected departments, with plans to extend it to other departments in September 2024.

3.3. Morbidity, Lethality and Recovery Rate

Table 2. Morbidity, Mortality Rates, and Recovery Time in the Three Provinces

	Number	Percentage
Morbidity	193	13.54%
Mortality	61	4.28%
Recovery Rate	132	68,39%
Total of Cattle	1426	100%

The time of recovery in all cases exceeded one month and was partial. Indeed, the severity, mortality, and recovery rates depend on several factors, primarily the strain of Capripoxvirus, as well as the age, immunological status, and breed of the host. *Bos taurus* is more susceptible to clinical disease than *Bos indicus*; the Asian buffalo has also been reported to be susceptible.

Within *Bos taurus*, the fine-skinned Channel Island breeds tend to develop more severe disease, with lactating cows appearing to be at the highest risk. However, even among groups of cattle of the same breed kept together under identical conditions, there is considerable variation in the clinical signs presented, ranging from subclinical infection to death (Carn & Kitching, 1995).

There may be a failure of the virus to infect the entire group, likely depending on the virulence of the virus isolate, the immunological status of the host, host genotype, and vector prevalence (Abera et al., 2015a,b).

3.4. Effects of Different Factors on LSD

Effect of Location

Table 3. Prevalence of Lumpy Skin Disease in the Three Departments

	Positives	Negatives
Blida	10	30
Tizi Ouzou	23	17
Bejaia	4	36

The p value = 0.00001576

The difference in prevalence among the three studied provinces was statistically highly significant.

Effect of Housing Quality

Table 4. Effect of Housing Quality on the Prevalence of Lumpy Skin Disease (LSD)

	Positives	Negatives
Bad	9	2
Mediocre	20	17
Acceptable	6	7
Optimal	1	58

The p-value= = 2.47e-13

The p-value of 2.47×10^{-13} indicates a highly significant effect of housing quality on the prevalence of lumpy skin disease, independent of other factors.

Effect of Hygiene Score

Table 5. Effect of Hygiene Score on the Prevalence of Lumpy Skin Disease (LSD)

	Negatives	Positives
Acceptables	6	5
Optimal	67	5
Dirty	10	25
Very dirty	0	2

The p-value= = 2.47e-13

The p-value of 2.134×10^{-11} indicates a highly significant effect of the hygiene score on the prevalence of lumpy skin disease.

The main questions to address are: Why are some regions and farms more affected by lumpy bovine dermatosis? What are the primary factors driving the spread and severity of this disease? What is the main source of the virus?

Lesions and nodules occurring on the mucous membranes of the eyes, nose, mouth, rectum, udder, and genitalia also ulcerate and release sufficient quantities of the virus, serving as sources of infection. Approximately half of the infected animals may develop clinical signs, while the majority of experimentally infected animals become viremic and thus serve as sources of the virus. The LSD virus has been detected in saliva for up to 11 days, semen for 22 days, and skin nodules for 33 days in experimentally infected cattle, but not in urine or feces (Tuppurainen, 2015, 2017a, b).

Capripoxviruses are highly resistant to physical and chemical conditions; consequently, they can survive in lesions or scabs for extended periods and exhibit a strong affinity for dermal tissues.

Lumpy Skin Disease (LSD) has been observed to occur under certain conditions, such as after seasonal rains when the populations of specific arthropod species increase (Talgedin et al., 2014).

A study investigating the risk factors associated with the development of LSD in Ethiopia found that a warm and humid agro-climate, which supports a high abundance of vector populations, was linked to an increased incidence of LSD (Babiuk et al., 2008). Evidence from multiple sources indicates that LSDV can be mechanically transmitted by various hematophagous arthropod vectors.

The disease exhibits high attack rates of 50–60% in areas with abundant mosquito populations, whereas morbidity is lower, ranging from 5–15%, in arid regions with fewer potential mechanical vectors (Gari et al., 2010, 2011, 2012, 2015).

Mechanical transmission of certain poxvirus species by insect vectors, such as *Stomoxys calcitrans*, may occur due to the high viral loads present in skin lesions (24). Invasive blood-feeding arthropods, including mosquitoes and sand flies, are suspected to be associated with LSD outbreaks characterized by generalized lesions (Weiss, 1968).

Stomoxys calcitrans and *Biomyia fasciata* were captured after feeding on sick cows, and the LSD virus was subsequently isolated from them (Chihota, 2003). Chihota et al. (2001) demonstrated that female *Aedes aegypti* mosquitoes can mechanically transmit LSDV from infected cattle to susceptible ones.

A vector that feeds regularly and switches hosts between feedings is likely to transmit LSDV mechanically (Chihota, 2001).

Chihota et al. identified the LSDV genome in mosquitoes (*Anopheles stephensi* and *Culex quinquefasciatus*) and biting midges (*Culicoides nubeculosus*) feeding on LSD-positive animals; however, they did not observe transmission of LSDV by these insects (Carn, 1993).

Direct and indirect contact may constitute minor sources of infection (e.g., through infective saliva contaminating feed and water). Poxviruses are highly resistant and can survive in infected tissues for more than 120 days or longer.

The virus has also been detected in blood, nasal discharge, lachrymal secretions, semen, and saliva, which are considered the primary routes of LSD transmission (Honhold et al., 2011).

Because the LSD virus can survive for extended periods in both milk and semen, other potential transmission vectors include nursing cow's milk and infected bull semen (Irons et al., 2005).

The role of hygiene conditions in the spread of contagious lumpy skin disease has been emphasized by several authors, including Gharbi (2025). It is essential to implement appropriate hygienic and sanitary measures, supported by tailored educational programs. Livestock housing and their surrounding areas must be kept free of filth, such as piles of stones, manure, and other debris.

Animal waste—including manure, slurry, and uneaten feed—must be collected daily, and the breeding premises cleaned regularly. The waste should be composted to ensure bio-fermentation, which effectively destroys the larvae and pupae of insects.

Through these control measures: a) there is a reduction in biomass flying insects that are attracted by faeces, urine, and manure; b) it is possible to rid the breeding of larvae and pupae of insects, notably those of muscids (*Musca spp.* and *Stomoxys spp.*).

An estimate of arthropod and insect populations can then be carried out (Duvallet, 2023); the flies do not find any substrate to lay their eggs, which normally consists of decaying organic matter, including both plant material (dead vegetation) and animal waste (human and animal feces).

Thus, cleaning livestock premises—even with water alone—and the proper management of livestock effluents (manure, slurry, wet straw, feed refusals, etc.) significantly reduce the biomass of *Stomoxys* species on farms (Duvallet, 2023).

3.5. Results of Logistic Regression

To identify the most influential factors affecting the prevalence of lumpy skin disease, a multivariate analysis using logistic regression was conducted.

This multivariate analysis revealed that the main factors influencing prevalence were proximity to industrial areas, thermal stress, and the quality of livestock housing.

It is well established that cattle are particularly sensitive to thermal stress. Therefore, enhancing their comfort and well-being is essential; otherwise, their immune system may become suppressed and their productivity may decline (Guerissi et al., 2025).

General conclusion and perspectives

4. General Conclusion and perspectives

In the present epidemiological study, lumpy skin disease outbreaks were investigated in three northern Algerian provinces: Bejaia, Tizi Ouzou, and Blida.

The disease affected all age groups of cattle, regardless of breed, sex, or vaccination status, and has already caused significant economic losses due to high mortality, morbidity, and case fatality rates.

Vaccine failure—potentially resulting from issues related to vaccine storage or the efficacy of the produced vaccines against the current field strain—requires serious attention. Accordingly, the following recommendations are proposed based on the above conclusions.

- Conduct broader and more detailed investigations, including genetic sequence characterization and analysis of the evolutionary relationship between field viruses and the currently used vaccine strain.
- Implement regular annual vaccination campaigns using effective and properly managed vaccines.
- Prevent the movement of diseased animals to new areas and apply strict vector control measures.
- Carry out annual surveillance to monitor the status and spread of the disease.
- Raise awareness among cattle owners about the importance of vaccinating healthy animals to control the disease, and providing proper care and nutrition to infected animals to reduce mortality, limit transmission, and improve recovery rates.

Finally, to enhance the scientific quality of this study, the survey should be conducted simultaneously across multiple provinces, considering that the month of occurrence is a highly influential factor.

To effectively combat this emerging disease, it is essential to combine chemical and biological control strategies. After several decades of sometimes excessive pesticide use, the limitations of chemical control have become evident, particularly due to the emergence of resistance in arthropod populations and the persistence of several insect species despite intensive control programs.

They have also demonstrated persistent and, quite often, serious toxicity to human health, animals, and the environment. Therefore, a new “philosophy of control” must be adopted by all stakeholders within a One Health framework. This approach should rely on more precise knowledge of the host–vector–pathogen system of LSD and promote eco-responsible alternatives that enhance ecosystem resilience.

Applied to the fight against lumpy skin disease, the approach we propose is innovative, as all stakeholders involved—farmers, veterinarians, and veterinary services—are traditionally accustomed to “shock actions,” which rely on the widespread and intensive use of pesticides in the hope of achieving immediate results.

The challenge, therefore, is to propose strategies inspired by the 'One Health' approach that promote the restoration and sustainability of resilient ecosystems through collective action. These strategies—primarily involving revegetation, restoration of ecological balance, and strict hygiene practices—may initially seem outdated, futuristic, or overly theoretical to various stakeholders in the livestock sector, and their effectiveness may not be immediately apparent.

Research efforts must therefore focus on understanding the perceptions and practices of breeders, calling upon the social sciences to identify the facilitators and barriers to the adoption of new control strategies.

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