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# Lumpy skin disease in the Middle East – historical and statistical data

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## ABSTRACT

**Introduction.** Lumpy skin disease (LSD) is currently a matter of veterinary concern due to the significant economic losses of the livestock industry. The risk of LSD spread and penetration into the disease-free countries is increasing every year. Therefore, timely monitoring of the infection spread for the development a strategy for this disease control becomes of current importance. Description of the disease manifestations and course, evaluation of historical and statistical data on LSD spread in the Middle Eastern countries as well as the further joint actions at the international level are presented in this review.

**Objective.** Analysis of historical and statistical data on clinical lumpy skin disease in the Middle Eastern countries.

**Materials and methods.** The following electronic databases were used for relevant data searching and collection: PubMed, Web of Science, eLIBRARY.RU, mdpi.com, frontiersin.org, researchgate.net, etc. English literature data for 10 years were analyzed.

**Results.** In 1988 LSD spread outside the African continent then LSD stayed for a short time within the Middle Eastern countries and two years later spread further to the west and east. Despite the further spread, recurrent LSD outbreaks were reported in the Middle Eastern countries over the next few years. Many countries in the Middle East still face the problem of uncontrolled livestock movement, lack of high-quality laboratory diagnostics, and irregular contacts with international health and surveillance organizations aggravated by the unstable political situation in the region. These problems indicate the importance of LSD control at the international level, the significance of regional and international cooperation and effective biosafety policies.

**Conclusion.** Role of the Middle East region in LSD virus spread, probable causes of LSD infection in the region, trends for further actions for LSD control were determined.

**Keywords:** review, lumpy skin disease, cattle, Middle East, historical outbreak, transboundary animal diseases

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# Заразный узелковый дерматит крупного рогатого скота на Ближнем Востоке – исторические и статистические данные

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## РЕЗЮМЕ

**Введение.** Заразный узелковый дерматит крупного рогатого скота, также известный как нодулярный дерматит, на данный момент представляет собой актуальную проблему ветеринарии вследствие значительного экономического ущерба, причиняемого животноводческой отрасли. Риск распространения заразного узелкового дерматита крупного рогатого скота и проникновения его в благополучные по заболеванию страны с каждым годом увеличивается. В связи с этим актуальным вопросом становится своевременное отслеживание распространения инфекции для выработки стратегии борьбы с ней. В представленном обзоре рассмотрены особенности проявления и течения заболевания, оцениваются исторические и статистические данные по распространению заразного узелкового дерматита крупного рогатого скота в странах Ближнего Востока и будущие направления совместных действий на международном уровне.

**Цель исследования.** Анализ исторических и статистических данных проявления заразного узелкового дерматита у крупного рогатого скота в странах Ближнего Востока.

**Материалы и методы.** Сбор теоретического материала проводился в электронных библиотеках с использованием ресурсов: PubMed, Web of Science, eLIBRARY.RU, mdpi.com, frontiersin.org, researchgate.net и др. Проанализированы англоязычные литературные данные за последние 10 лет.

**Результаты.** После выхода вируса заразного узелкового дерматита крупного рогатого скота за границы Африканского континента в 1988 г. он не надолго задержался в пределах стран Ближнего Востока, уже через два года проникнув далее на запад и восток. Несмотря на дальнейшее распространение, в ближневосточных странах еще в течение нескольких последующих лет отмечались повторные вспышки заболевания. Многие страны Ближнего Востока все еще сталкиваются с проблемой бесконтрольного перемещения скота, отсутствием возможностей для проведения качественной лабораторной диагностики, нерегулярностью контактов с международными организациями в сфере здравоохранения и надзора, усугубляемыми нестабильностью политической ситуации в регионе. Данные проблемы подчеркивают важность борьбы с заразным узелковым дерматитом крупного рогатого скота на международном уровне, значение регионального и международного сотрудничества и проведения эффективной политики биобезопасности.

**Заключение.** Определена роль Ближневосточного региона в распространении возбудителя болезни, названы вероятные причины неблагополучия региона по данному заболеванию, сформулировано направление дальнейших действий в рамках борьбы с заразным узелковым дерматитом крупного рогатого скота.

**Ключевые слова:** обзор, заразный узелковый дерматит, крупный рогатый скот, Ближний Восток, историческая вспышка, трансграничные болезни животных

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## INTRODUCTION

Lumpy skin disease is currently a matter of veterinary concern due to the significant economic losses to the livestock industry caused by this disease. Lumpy skin disease is caused by a DNA virus genus *Capripoxvirus*, family *Poxviridae*, and affects cattle and water buffaloes and characterized by skin nodules in infected animals. This virus is antigenically closely related to sheep poxvirus and goat poxvirus, therefore it can infect small ruminants without any clinical disease manifestations [1, 2, 3].

The disease is enzootic, rapidly explorative and sometimes fatal infection, despite the fact that, as often reported, LSD is characterized by high incidence rate (more often about 20%, but it can vary from 3 to 85%) and rather low mortality rate (less than 5%) [4, 5, 6, 7]. LSD affects food-producing animals that results in reduced milk yields in dairy animals and decreased weight gains in meat animals that has a negative effect on food security due to limited availability of high-quality animal products on the world market. Reproductive performance in infected animals as well as quality of hides derived from slaughtered animals significantly reduce [2, 5, 6, 8, 9, 10]. In addition, the disease affects trade links and requires financial costs for anti-epizootic measures. Taking into account its ability to spread rapidly across the borders of countries and cause significant damage, the World Organization for Animal Health has included LSD in the list of the most economically significant and notifiable transboundary viral animal diseases.

Lumpy skin disease was first reported in 1929 in Northern Rhodesia (now Zambia) and since that time the disease outbreaks have occurred in various parts of Africa. But the disease was contained to the African continent. In 1988–1989 the disease cases were registered in Egypt and Israel, and then LSD began to progressively spread to

the countries of the Middle East, Eastern Europe, Russia and the Balkan Peninsula [4, 11, 12].

In 2019 LSD has already been reported in South and East Asia. This has put livestock industry at risk in such countries as Afghanistan, Pakistan, India, etc. LSD is also detected in cattle in China, Cambodia, Singapore, and Indonesia, and there is a threat of LSD spreading to the LSD-free countries with significant livestock populations (Australia, etc.) [4, 6]. There are also the first reports LSD in humans [10], although, according to other data, the virus is not transmitted to humans [2].

The risk of further LSD spread and penetration into the disease-free countries is increasing every year. Therefore, timely monitoring of the infection spread for the development a strategy for this disease control becomes of current importance.

Description of the disease manifestations and course, evaluation of historical and statistical data on LSD spread in the Middle Eastern countries as well as the further joint actions at the international level are presented in this review.

The work was aimed at analysis of historical and statistical data on clinical lumpy skin disease in the Middle Eastern countries.

## MATERIALS AND METHODS

English literature data on LSD in the Middle East for the last 10 years were analysed. The following electronic databases were used for relevant data searching and collection: PubMed, Web of Science, eLIBRARY.RU, mdpi.com, frontiersin.org, researchgate.net, etc.

## STUDY RESULTS

Lumpy skin disease is transmitted by biting insects. The virus is transmitted by blood-sucking mosquitoes

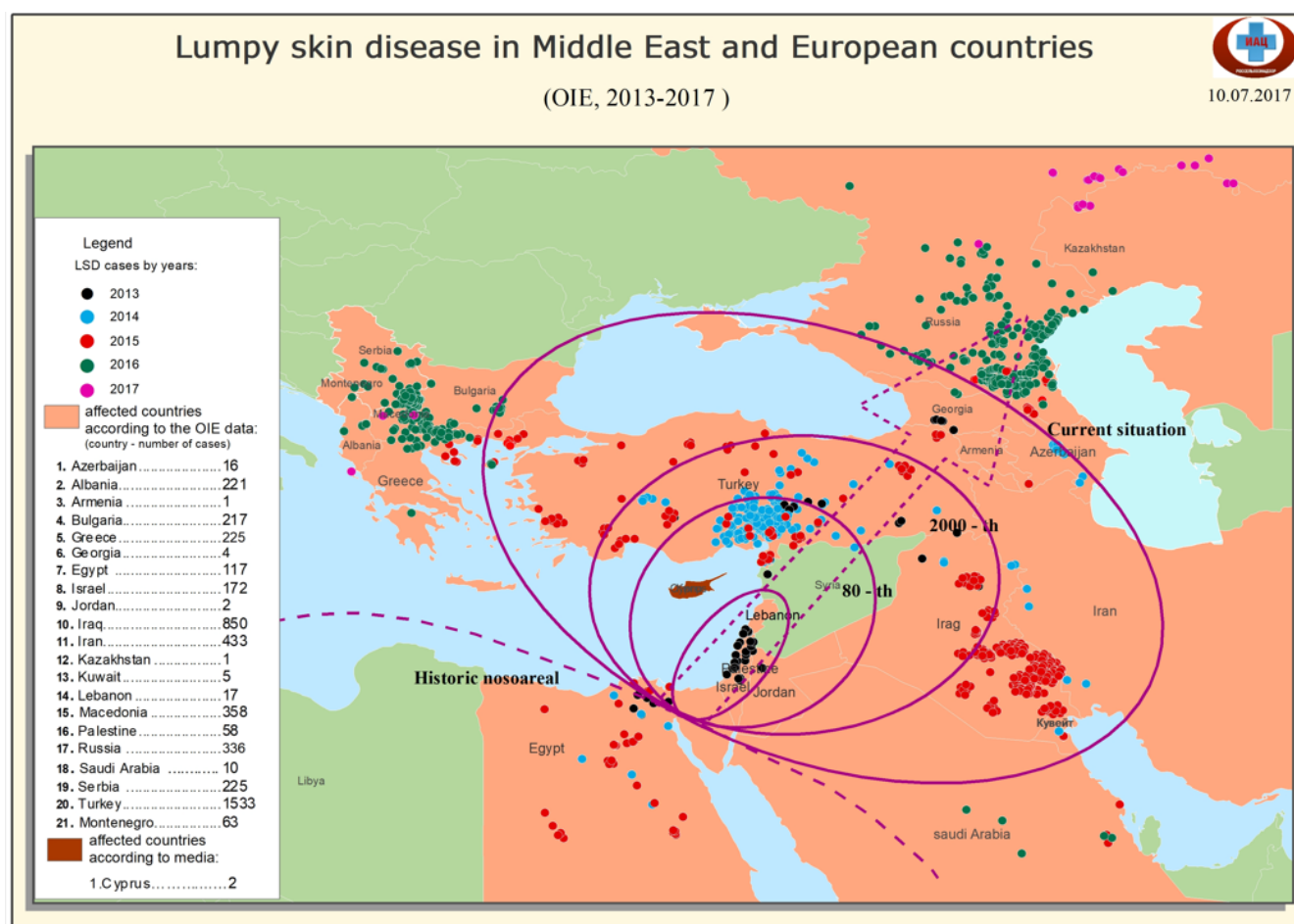


Fig. 1. LSD outbreaks reported from 2013 to 2017 in the Middle East region and neighboring countries [18]

(*Aedes aegypti*), biting flies (*Stomoxys calcitrans*, *Haematobia irritans*, *Musca domestica*) and some tick species (*Rhipicephalus appendiculatus*, *Rhipicephalus decoratus*, *Amblyomma hebraeum*) [13]. LSD can also be transmitted by non-vector route, through contact of animals with fomites (feeders, waterers), through milk, semen, or in utero [6, 10]. Hot and humid climate, rainy seasons, and low-lying, swampy terrain are factors contributing to multiplication of LSD vectors [1, 4, 9].

Clinical LSD takes the following forms: acute to subclinical or chronic form. The main symptoms include fever, lack of appetite, oedema, generalized nodular skin lesions, enlarged lymph nodes, emaciation, nodular lactation and abortions in pregnant animals. Severe LSD form is characterized with ulcerative mucosal lesions in oral cavity, larynx, trachea and esophagus. LSD virus localized in the reproductive system can cause temporary or permanent infertility in cows and bulls [7, 8, 9].

The virus is excreted by various routes: via lachrymal and nasal secretions, blood, saliva, milk, and semen of the infected animals. Nodules appearing on the mucous membranes of the eyes, nose, mouth, rectum, udder and genitalia quickly and then ulcerating can be attributed to the priority routes of virus shedding [9].

Strict quarantine of animals entering the farm, control of disease vectors, and preventive livestock vaccination are the most important measures for LSD eradication and prevention. Measures for LSD control at the international level, regional and international cooperation,

and an effective biosafety policy are also of great importance [14].

The first LSD case in Northern Rhodesia in 1929 was considered to be hypersensitive response of animals to insect bites and was designated by the term "pseudocraniaria". The infectious nature of the disease was discovered in the period from 1943 to 1945, when LSD was already recorded in Southern Rhodesia (now Zimbabwe), Botswana and South Africa. By 1946, the disease had spread to Mozambique, in 1950 it was detected in Angola and Zaire, in 1954 – on Madagascar, in 1956 – in Namibia, Tanzania and Uganda. Over the next three decades, LSD were reported in different African countries (Kenya, Sudan, Chad, Niger, Ethiopia, etc.), and therefore the virus has long been considered endemic to African countries [4, 10].

After the disease was reported in Egypt in 1988–1989, LSD spread outside the African continent and was detected in Israel. Earlier, in 1984, LSD outbreak was reported in Oman, but disease cases were not confirmed, although the disease cases were repeatedly reported in 2009. In 1986, LSD was detected in Kuwait, and the second LSD outbreak occurred in 1991. The disease was reported in Lebanon in 1993, in Yemen in 1995, in the UAE in 2000, in Bahrain in 1993 and again in 2002, and in Saudi Arabia and Iraq in 2013 [4, 15].

In 2014 LSD outbreak was reported in Azerbaijan. In 2015 LSD was registered in such European countries as Greece, Albania and Russia (another extensive outbreak occurred in Russia in 2017). Large-scale vaccination against



LSD was initiated in European countries for prevention of the wide spread of infection, but disease cases nevertheless occurred [16]. In 2016 and 2018 LSD was reported in Georgia, and in 2018 it was detected in such countries of the Balkan Peninsula as Greece, Bulgaria, North Macedonia, Serbia, Kosovo and Albania [4, 17].

Figure 1 shows map of LSD outbreaks reported in 2013–2017 in the Middle East and neighbouring countries [18].

Since 2019 LSD has become a serious problem for live-stock industry in Asian countries. The disease caused devastating outbreaks in Bangladesh (2019–2020), then in India and China (2020), spread further to Nepal, Bhutan, Sri Lanka, Vietnam and Malaysia (2020). In 2021 LSD was reported in Thailand, Laos NDR, Pakistan and detected in Indonesia and Singapore in 2022 [4].

Morbidity and mortality reported during the Eurasian epizootics are approximately 10% and 1%, respectively, which, according to some authors, depends on the genetic predisposition of cattle to LSD.

As for Middle East region, LSD stayed for a short time within the region after spread outside the African continent and two years later spread further to the west and east. In the Middle East region, recurrent disease outbreaks were reported over the next few years. Some of them reported in the scientific literature are described below.

In 2012–2013, LSD virus was detected in Syria and Iraq. The unstable political situation, civil conflicts and wars had a negative impact on the veterinary services activities, contributing to the further pathogen spread to neighbouring countries of Southwest Asia [1, 6]. No specific treatment of infected animals was performed, and

conservative intervention was limited to symptomatic therapy [6].

In 2013, LSD was detected in Turkey near the borders to Syria and Iraq [19, 20, 21, 22, 23]. The infected animals were not vaccinated against the infection. Mass immunization of cattle had been started in Turkey since 2014, but outbreaks had been still recorded until 2019 [6, 24].

In 2013 LSD was found in cattle in Jordan. Infected herds were treated with broad-spectrum antibiotics and anti-inflammatory drugs [6].

In 2014 LSD was still recorded in Iraq (9 disease outbreaks were reported in 2014) [9, 25].

In 2014–2016, the disease outbreaks were reported in Iran, where the disease presumably spread from Iraq due to the uncontrolled movements of infected animals across the common border [26, 27, 28]. According to P. Samea Yousefi et al. [7] 683 cattle were examined for LSD clinical signs (fever, lack of appetite, decreased milk yield, detection of typical skin nodules and enlarged lymph nodes) during two-year observation period and the above-mentioned signs were detected in 122 cattle (prevalence – 17.9%). Therewith, the highest disease incidence rate was observed in animals older than 5 years, and the lowest in animals younger than 6 months. In vaccinated cattle, clinical signs were observed in 40.8% of animals, in non-vaccinated cattle – in 71.3% of animals. At the disease prevalence of 17.9%, the total mortality and lethality in the four examined Iranian provinces were 3.5 and 19.7%, respectively, that was non-consistent with earlier data from Turkey (12.3% morbidity and 6.4% mortality) [29], Oman (13.6–29.7% morbidity and 15.4–26.3% mortality) [30], Jordan (26.0% morbidity and 1.9% mortality) [31],

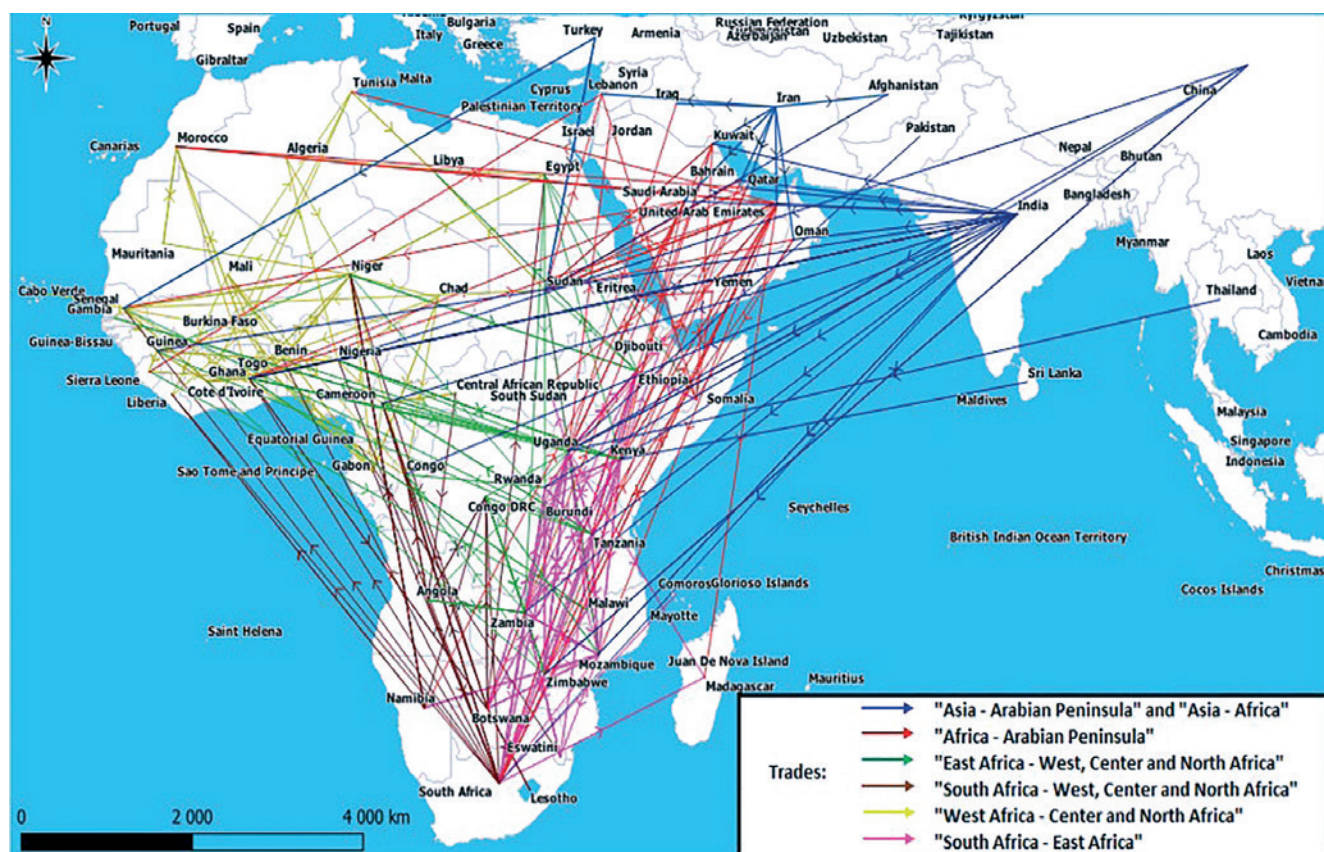


Fig. 2. Mapping of irregular flows of domestic ruminants in Africa and their links to Asia [34]

**Table**  
**LSD outbreaks sequentially reported in different world regions**

Year	Country	Virus origin	Possible ways of further spreading	Time of LSD virus staying within one region before further spreading
1929	Zambia	unclear	neighbouring African countries	59 years within the African continent
1943	Botswana	Zambia	Zimbabwe and South Africa	
1944–1945	Zimbabwe, South Africa	Zambia, Botswana	Sudan and Ethiopia	
1946–1956	Mozambique, Angola, Madagascar, Tanzania, Uganda	Zambia, Botswana	Border countries where cattle was imported	
1957	Kenya	unclear	African countries – cattle importers	
1971	Sudan	insufficient data	insufficient data	
1973–1974	Chad, Niger, Nigeria	Cameroon via Gongola State in Nigeria	insufficient data	
1981–1983	Ethiopia	Sudan	insufficient data	
1983	Somalia	insufficient data	insufficient data	
1988–1989	Egypt	African countries	European countries and Israel	2 years within the Middle East countries
1989	Israel	Egypt	insufficient data	
1990–2010	Mediterranean countries	Egypt, Israel	All neighbouring countries	20 years – spread to the Mediterranean countries
2012–2014	Mediterranean countries	Syria, Iraq	Greece, Bulgaria	6–7 years – Eurasian LSD epizootic (spread of the virus in the South Eastern European, Middle Eastern and Eurasian countries)
2013	Turkey, Iran	Syria, Iraq	insufficient data	
2015–2017	Russia	Turkey, Azerbaijan, Iran, Kazakhstan	Northern regions of Europe	
	Countries located in the Balkan Peninsula	Turkey	Central and South Asian countries	
2019	Bangladesh	Perhaps neighbouring countries	India, Myanmar	5 years – spread in Southeast Asian Countries
	India		Nepal, Bhutan	
2019	China	Kazakhstan, Russia	Taiwan	
2020	Nepal	India, China	unknown	
	Vietnam	China	unknown	
2021	Thailand	unknown	insufficient data	
	Pakistan	India	not clear	
	Mongolia	Russia, China	China, India	
	Cambodia	not clear	not clear	
2022	Afghanistan	unknown	insufficient data	
	Korea	China, Nepal	insufficient data	
	Indonesia	India	Indonesia, threat to the northern regions of Australia	
2023	Libya	unknown	Tunisia and other Northwest African countries (Maghreb)	

Saudi Arabia (6.0% morbidity and 0.99% mortality) [32]. This inconsistency of the data on the disease prevalence and mortality is explained by the authors of the above study by variability of factors contributing to LSD (climate humidity, ambient temperature, etc.).

In 2018 and 2019, outbreaks continued in Iraq, namely in Basra province. The overall disease prevalence in all age groups of cattle was 18.7% (112 infected animals were detected out of 600 examined animals). LSD was detected in 92.8% of diseased animals, arthritis in 17.8% of diseased animals, and lymphadenopathy was detected in 2.5% of diseased animals [8].

The organization and quality of animal movement control and specific LSD prevention in the Middle Eastern countries depend on the well-coordinated activities of veterinary services. Stamping out of infected animals carried out in Egypt and Israel enabled LSD eradication in these countries in 2006. However, other Middle Eastern countries still face the problem of uncontrolled livestock movements, lack of high-quality laboratory diagnostics, and irregular contacts with international organizations in the field of animal health and surveillance, exacerbated by the unstable political situation in the region [1].

## DISCUSSION AND CONCLUSION

Lumpy skin disease is a serious problem for livestock industry in many countries due to its rapid spread and resulting economic losses. The disease originated from African countries has gradually affected Middle Eastern and Asian countries and now threatens Western Europe and Australia. Joint efforts aimed at livestock movement control, reducing the risk factor, destruction of contaminated objects (dead animals and infected materials) are required for prevention of the further LSD spread and for LSD eradication in the countries already affected by this disease.

Currently, infection spread control is of particular importance due to the significant number of outbreaks reported in the Middle East, and risk of LSD transmission out of this region both to the west, towards the Balkan Peninsula and Europe [33], and to the east and southeast, towards Asian countries and further to Australia and New Zealand, having large cattle populations and remaining free from the disease. The further LSD spread could lead to significant economic losses in the global livestock sector.

Therefore, the Middle East can be considered as a port of entry for the infection spreading outside Africa to Europe and Asia. Thus, Figure 1 clearly shows the spread of the disease from Egypt and Israel to other countries in the Middle East, then westward to the Balkan Peninsula, northward to the southern regions of Russia, and eastward to Asian countries.

The rapid LSD virus spread in different countries can be accounted for cattle movements across international borders and for migration of blood-sucking insects regarded as disease vectors.

Figure 2 shows the directions of domestic ruminant movements in Africa and Middle East and links of livestock migration flows in these regions with Asian countries [34]. The map shows that the Middle East has close links with African and other Asian countries as for livestock purchase and sale. This significantly increases the risk of transmission of infectious large and small ruminant diseases through the territories of Middle Eastern countries to new territories.

Time intervals of LSD appearance on each of the continents were examined.

Aggregated table on the reported disease outbreaks shows that since its first occurrence in Zambia, from 1929 to 1988, i.e. for 59 years, the disease had remained within the borders of the African continent, and therefore LSD was considered endemic to African countries. There is no information about the country from which LSD virus was introduced into the Middle East, in Egypt, in 1988, although there are data on its further spread: the virus was introduced from Egypt to Israel, and in the next year both of these countries became the port of the pathogen entry to the Mediterranean countries, as well as other Middle Eastern countries. That was the way of LSD virus spread from the African continent to the Middle Eastern countries and further to the western (Mediterranean countries) and eastern (South, East and Southeast Asian countries) regions [35].

It should be noted that LSD virus “stayed” in the Middle East for the short period before its further spread to the Balkan Peninsula and further to the east to other Asian countries. This can be accounted for historically highly intensive trade relations in this region, climate suitable for virus vectors and insufficient control by veterinary surveillance authorities.

Specific preventive vaccination is currently the only effective method for LSD outbreak prevention, therefore, mass vaccination appears to be an important component of the general disease control strategy. In addition to cattle vaccination, strict quarantine measures for incoming animals, as well as slaughter of the diseased animals are required for successful eradication of LSD. Veterinary supervisory authorities should ensure strict control over LSD susceptible animal movements between neighbouring countries. Thus, the disease control should be carried out in animal farming industry at all levels: from farm to international supervisory agencies.

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