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Bluetongue Disease in Small Ruminants in Palestine: A retrospective Study Between the Period of 2005-2019

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SMALL ruminant's livestock industry provides a major source of livelihood for many people worldwide, particularly the rural poor in developing countries. Bluetongue (BT) is a reportable infectious non-contagious disease of the small ruminant that has considerable socioeconomic importance in livestock in Palestine. The objective of the current study was to investigate the epidemiological analysis of BT within small ruminants in Palestine over 14 years 2005 – 2019. The retrospective numbers of BT outbreaks, cases, and deaths from the World Organization for Animal Health were analyzed. The study indicated that BT is enzootic in Palestine, reported started from 2009. A total of 273 outbreaks include 1628 cases resulted in 351 deaths were reported. A total of 273 outbreaks, 1628 cases, and 351 deaths were recorded in small ruminants. The incidence rate average was 5.5%, and the average mortality rate was 1.6%. The case fatality rate ranged from 0.0- 39.29 % with an average of 20.2%. No vaccination practice was applied in Palestine. Temporal analysis obtained that BT is more endemic in the low-temperature season between September and December, with a higher peak in November, displaying `overwintering` of BTV in Palestine. At least five BTV serotypes BTV (2, 4, 5, 6 and 8) were continuously present in Palestine. Multiple serotypes were recorded in the same outbreak period increase the risk for re-assortment of individual BTV gene segments. Efficient data recording, enhance owner awareness, use of the vaccine and a systematic BT monitoring program are required to control and eradicate the disease.

Keywords: Bluetongue disease, Epidemiology, Palestine, Serotypes.

Introduction

Small ruminants have great socioeconomic importance of the Palestinian population as a source of food and in trade [1]. Bluetongue (BT, other names: Sore muzzle and Ovine catarrhal fever) is a World Organization for Animal Health (OIE) reportable, infectious, non-contagious disease of the ruminants [2]. The disease is a non-zoonotic insect-borne viral disease that affects ruminants mainly sheep, causing a great economic loss as a result of reducing the international trade, high morbidity, and mortality rates [3, 4]. The clinical signs of the disease range from subclinical to a fatal outcome, depending on the animal species, the virus serotype, the nutritional and immune status of the affected animal, and the environmental conditions. The severity of the disease is mild to subclinical in goats, cattle, and wild ruminants. However, these animals can act as a reservoir for BTV circulation and genetic re-assortment [5].

Bluetongue disease is caused by bluetongue virus (BTV), which consists of double-stranded RNA (dsRNA), that belongs to the *Orbivirus* genus within the *Reoviridea* family [6]. The genome consists of ten segments (Seg1-Seg 10), encoding structural viral proteins VP3, VP7, and VP2 and VP5, respectively. Currently, BTV has been listed in 28 different serotypes distributed

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around the world based on Seg 2 sequence [7]. The virus is transmitted by a vector known as *Culicoides* biting midges as well as transplacental transmission resulting in severe congenital malformations [8].

The disease distributed worldwide, mainly in the developing country of Asia, the Middle East, and Africa [9, 10]. The inadequate resources and veterinary services limited the control or eradicate the disease. Epidemiological studies related to the incidence, prevalence, and serotypes of BTV are available from many countries [10, 11]. However, the data of BT disease in Palestine has not been studied before. Therefore, this study was performed to provide retrospectives of BT epidemiology in Palestine for 14 years. This information would be essential to know the disease incidence, mortality, dynamics, and temporal distribution. In addition, support the application of the preventative measures to control and eradicate the disease.

Methodology

Bluetongue disease temporal and annual trends

The numbers of BT outbreaks, cases, and deaths reported on the period 2005 to 2019 were collected. These data were based on reports of the World Organization for Animal Health (http://www.oie.int/), submitted by Palestinian governmental veterinary services.

Analysis

The numbers of the outbreaks, case, incidence, mortality, and case fatality rate of BT were considered in each month of the study period according to the following formulae [12]:

- Incidence rate: number of cases per year divided by the number of susceptible animals during the outbreaks in the same year X 100
- Mortality rate: number of deaths divided by the number of susceptible animals during the outbreaks at the same year X100
- Case fatality rate: number of deaths divided by number of cases

Data analyses and figures were performed using Graph-Pad Prism version 5 (GraphPad Software Inc., San Diego, US).

Results

Annual statistics of BT in sheep and goat

The collected retrospective data of BT for the study period in Palestine are shown in Table 1. The cumulative numbers during the study period showed a total of 273 outbreaks, 1628 cases, and 351 deaths. The average incidence rate, average mortality rate and case fatality rate were 5.5%, 1.6%, and 20.2% respectively. No vaccination history was recorded in Palestine.

Outbreaks of bluetongue disease have occurred in Palestine in each year from 2009-2019. The following BTV serotypes were recorded: 2, 4, 5, 6, and 8 (Table 1). Multiple serotypes were recorded in 2013 (2, 4), 2015 (2, 4), and 2016 (2, 4, 5, 8). The serotypes in outbreaks in the years 2011, 2012, and 2018 were not determined (Table 1).

The findings of the present study showed that outbreaks occurred from 2009-2019 (Fig. 1). The highest number of outbreaks reported in 2012 (n=100), followed by 2013 (n=42). The lowest outbreaks number reported in 2015 (n=2) (Fig.1).

The highest incidence rate was observed in 2019 (15.23 %), followed by 2010 (14.55%) and 2017 (10.77 %). The lowest incidence rate occurred in 2015 (0.05 %). The highest mortality rate was reported in 2013 (4.96%), followed by 2012 (3.94%). Upon the two outbreaks reported in 2015, there is no death (Table 1). The highest case fatality reported in 2009 (39.29%) then in 2017 (32.99%), and the lowest reported in 2015.

Temporal distribution

Data for numbers of outbreaks, susceptible animals, number of cases, and number of deaths were collected for each month for the period January 2005 to December 2019, mortality and case fatality were calculated and shown in table 2. During this period, the disease occurred in all months of the year, but the highest number of outbreaks occurred in November (Table 2, Figure 3). Most of the reported outbreaks occurred in the autumn and winter seasons between September and December (Figure 3). The lowest outbreaks, lowest incidence, and mortality reported in the spring and summer season (May-June). The highest mortality and case fatality rate occurred in August. The severity of the disease increases in April, September October, and November with the highest case fatality rate (Table 2).

Discussion

Bluetongue (BT) is a reportable infectious non-contagious disease of the small ruminant. The disease has socioeconomic importance in the small ruminants in Palestine. In the present study, the epidemiological characteristic of BT

TABLE 1: Annual statistics of BT in sheep and goats in Palestine (2005-2019).

Year	Outbreak	Susceptible	Cases	Deaths	Incidence (%)	Mortality (%)	Case Fatality (%)	Serotype
2005	NA	NA	NA	NA	NA	NA	NA	NA
2006	NA	NA	NA	NA	NA	NA	NA	NA
2007	NA	NA	NA	NA	NA	NA	NA	NA
2008	NA	NA	NA	NA	NA	NA	NA	NA
2009	10	402	28	11	6.97	2.74	39.29	8
2010	6	797	116	23	14.55	2.89	19.83	8
2011	10	1362	53	2	3.89	0.15	3.77	ND
2012	100	3970	262	79	6.60	1.99	30.15	ND
2013	42	4600	254	40	5.52	0.87	15.75	2,4
2014	9	330	17	6	5.15	1.82	35.29	2
2015	2	11003	5	0	0.05	0.00	0.00	2,4
2016	24	1958	140	28	7.15	1.43	20.00	2,4,5,8
2017	16	2731	294	97	10.77	3.55	32.99	6
2018	38	4038	297	53	7.36	1.31	17.85	ND
2019	16	1064	162	12	15.23	1.13	7.41	4

NA: Not available, ND: Not determined

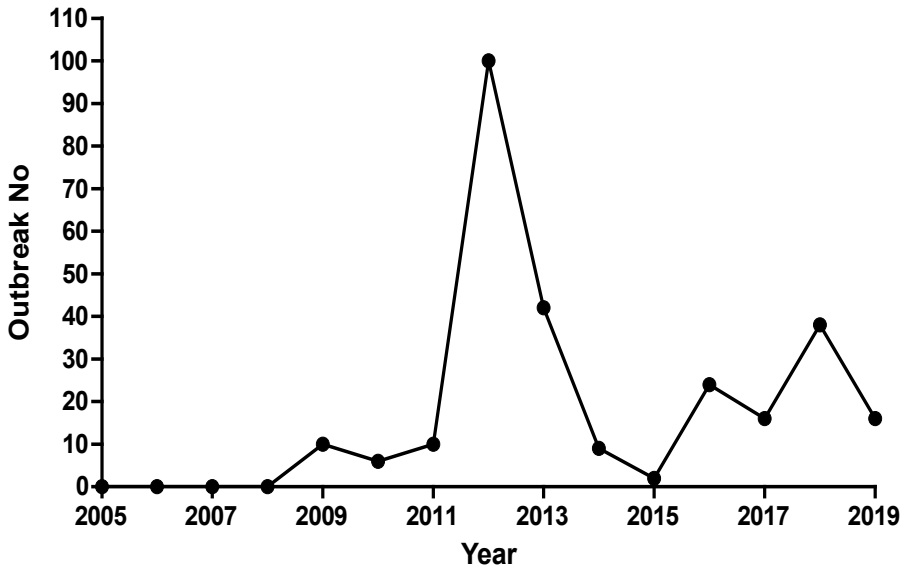

Fig. 1. Numbers of BT outbreaks reported in sheep and goats in Palestine during 2005-2019.

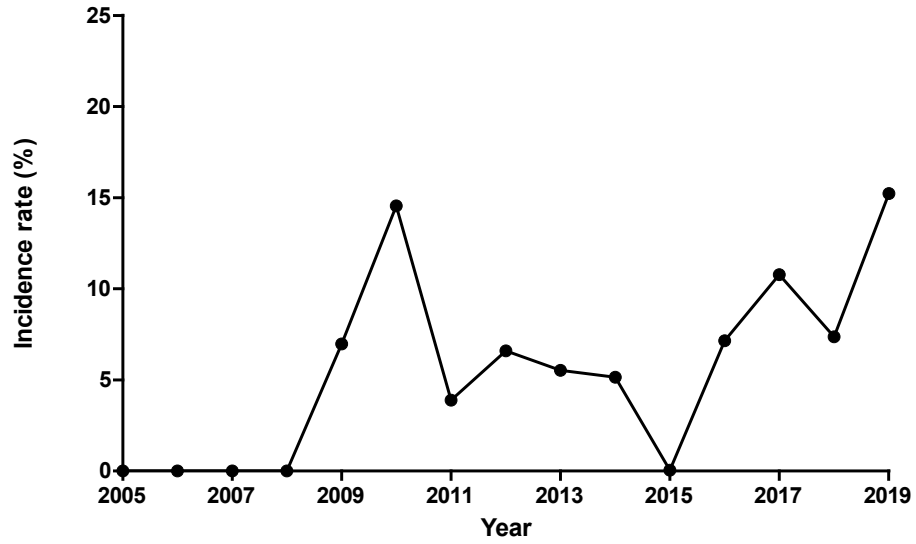

Fig. 2. Incidence rate of BT upon the susceptible animals in Palestine (2005-2019). The Incidence rate is the percentage of cases in of the susceptible animals during the outbreak.

in Palestine was discussed and the circulating serotypes were mentioned for the first time.

BT was first observed in the country in 1944 [13]. Till 2009, data regarding the occurring of the disease and circulating serotypes in Palestine was not available. Starting from 2009, numbers of outbreaks, cases, and deaths have been reported in OIE. Enzyme-linked immune assay (ELISA) and real-time reverse transcriptase-polymerase chain reaction (Real-Time RT-PCR) were used for diagnosis and serotype detection. During the investigated period, BT was enzootics in Palestine, the incidence rate ranged from 0.05-15.23%, mortality rate of 0.0- 3.55%, and case fatality was 0.0-39.29%. The morbidity, mortality, and case-fatality rates recorded in Palestine during the present study are close to those in other countries [14, 15]. Certainly, other outbreaks, cases, and deaths, were clinically observed but not recorded as a result of inadequate surveillance systems. The incidence, morbidity, and mortality rates significantly differ concerning the diverse of determinants such as bluetongue virus serotype, breed susceptibility, previous infection, the vector ecology, and health status [16].

In most years, only one serotype has been encountered in clinically affected sheep. However, this study showed the presence of multiple BTV infections in the same susceptible animals in the same year. The identification of multiple co-infecting (or co-circulating) BTV serotypes increases the likelihood of genome re-assortment, which could potentially lead to the formation of increased virulent strains [17]. BTV serotypes recorded in Palestine are: 2, 4, 5, 6, and 8 (Table 1). Multiple serotypes were recorded in 2013 (2, 4), 2015 (2, 4), and 2016 (2, 4, 5, 8) in the same outbreak. Serotypes 2, 4, 6, and 8 are originated and distributed in Europe and Mediterranean Basin, while serotype 5 has an Eastern Asia origin, and serotype 6 has a Middle East origin [11, 18, 19]. Other recorded serotypes in the Middle East are serotypes 1, 2, 4, 6, 8, 10, 16, and 24 [13, 20]. However, the interpretation of the BT status and BTV serotypes in the developing countries of Africa and the Middle East is complicated by the lack of adequate surveillance in many areas.

BTV is an arbovirus, and the incidence of the disease is related to the insect *Culicoides* midges as a vector of the virus. The insect's activities are highly related to the seasonal changes in temperature, availability of water, and other climatic variables. Palestine has a temperate, Mediterranean climate, with a rainy season between November and April [21]. Our findings showed that the temporal distribution of BT in

TABLE 2: Seasonality of BT in Palestine (January 2009 to December 2019)

Month	Outbreak	Susceptible	Cases	Deaths	Mortality (%)	Case fatality (%)
Jan	16	1680	135	17	1.01	12.6
Feb	24	2739	135	17	0.62	12.6
Mar	5	240	23	23	9.58	100.0
Apr	5	615	51	5	0.81	9.8
May	1	100	9	0	0.00	0.0
Jun	5	297	31	4	1.35	12.9
Jul	3	598	109	25	4.18	22.9
Aug	6	872	128	48	5.50	37.5
Sep	29	2739	237	51	1.86	21.5
Oct	53	4441	338	88	1.98	26.0
Nov	80	5610	341	89	1.59	26.1
Dec	50	1328	127	15	1.13	11.8

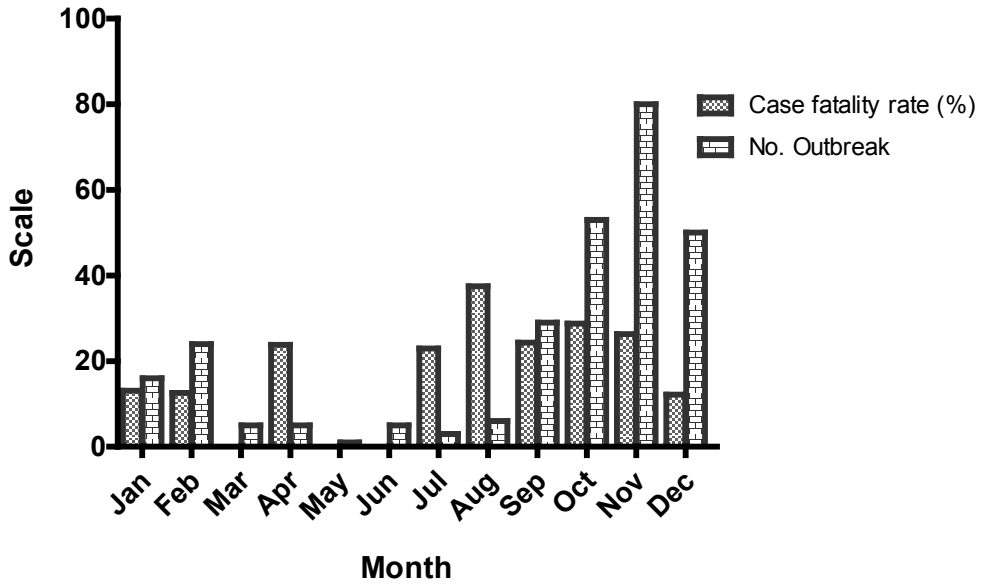

Fig. 3. Seasonality of BT in sheep and goats in Palestine (January 2009 to December 2019)

Palestine showed activities peaked during the autumn to the winter (September to December). This is a period of low temperature and expects to reduce the insect activity comparing to the spring and summer season[22]. The persistence of BTV in the cold weather is well documented and known as 'overwintering' of BTV in endemic temperate regions [23]. The detection of BTV in pools of productive female midges during the warm period, with a long lifespan, represents most likely the mechanism of BTV overwintering. The female midges infected during the prior seasonal period of virus transmission, it is further likely that these infected productive midges were less active in the fall and re-emerged in midwinter during a transient period of higher temperature [24]. Besides, for the female midges, the transmission from warm to a cold period typically requires 6 months period in temperate regions [24]. Besides, adult *Culicoides* may also be sheltered from the worst conditions of winter to a resting place in the farm and animal shelter [25]. The transmission of the virus increased with low temperature and enhance its spread with the

occurrence of wind [26]. These facts can explain the extent of higher indices in the cold weather in Palestine. Our findings are in agreement with other reported in India, Italy and Germany describing the overwintering of BTV [14, 27, 28]. Regarding case fatality, the highest rate indicates the severity of the disease observed during the endings of summer and autumn season. The fatality rate ranged from 0.0 % to 37.5%. Our finding is similar to other studies of the epidemiology of the disease in India and Germany where the fatality rate was ranged from 2.37% to 38.14%, while lower than case fatality caused by BTV serotype 8 in sheep in Netherlands [14, 27, 29].

In conclusion, BT is enzootic in Palestine, revealed a considerable number of outbreaks and death. Multiple serotypes circulation all over the year implying that BT is considered a serious problem. Although the observations regarding the morbidity/mortality of BT in Palestine, research publications reporting these findings are not available. Despite the economic impact of the disease in Palestine, no vaccination or eradication measures were adopted.

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Conflict of interest

The authors have declared that no conflict of interest exists.

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References

1. Sinjilawie, N. and Nori, M. Livestock breeding and food security in today›s Palestinian Territories. *Tropicultura.,* **23**(I), 21-27(2005). https://pure.itg.be/files/284245/2005trop0064.pdf#page=22.

2. Alkhamis, M.A., Aguilar-Vega, C., Fountain-Jones, N.M., Lin, K., Perez, A.M. and Sanchez-Vizcaino, J.M. Global emergence and evolutionary dynamics of bluetongue virus. *Sci. Rep.,* **10**(1), 1-12. (2020). DOI:10.1038/s41598-020-78673-9.

3. Rushton, J. and Lyons, N. Economic impact of Bluetongue: a review of the effects on production. *Vet. Ital.,* **51**(4), 401-406(2015). DOI:10.12834/VetIt.646.3183.1.

4. Rojas, J.M., Rodriguez-Martin, D., Martin, V. and Sevilla, N. Diagnosing bluetongue virus in domestic ruminants: current perspectives. *Vet. Med. (Auckl).,* **10**(1)17-27. (2019). DOI: 10.2147/VMRR.S163804.

5. Van den Bergh, C., Coetzee, P. and Venter, E.H. Reassortment of bluetongue virus vaccine serotypes in cattle. *J. S. Afr. Vet. Assoc.,* **89**(0), 1-7. (2018). DOI:10.4102/jsava.v89i0.1649.

6. Mohl, B.P., Kerviel, A., Labadie, T., Matsuo, E. and Roy, P. Differential localization of structural and non-structural proteins during the bluetongue virus replication cycle. *Viruses,* **12**(3), 1-2. (2020). DOI:10.3390/v12030343 .

7. Bumbarov, V., Golender, N., Jenckel, M., Wernike, K., Beer, M. Khinich, E., Zalesky, O. and Erster, O. Characterization of bluetongue virus serotype 28. *Transbound Emerg. Dis.,* **67**(1), 171-182. (2020). DOI:10.1111/tbed.13338.

8. Savini, G., Maclachlan, J.N., Batten, C., van Rijn, P.A., Zientara, S., Darpel, K.E., Lorusso, A. and Hudelet, P. Bluetongue. *Veterinary Vaccines: Principles and Applications.,* 263-281. (2021).

9. Mogajane, M.E. Trade implications of blue tongue in Africa. *Vet. Ital.,* **40**(4), 691-692. (2004). https://www.ncbi.nlm.nih.gov/pubmed/20422615.

10. Taylor, W.P., Sellers, R.F., Gumm, I.D., Herniman, K.A. and Owen, L. Bluetongue epidemiology in the Middle East. *Prog. Clin. Biol. Res.,* **178**, 527-530(1985). https://www.ncbi.nlm.nih.gov/pubmed/2989898.

11. Maclachlan, N.J. Bluetongue: history, global epidemiology, and pathogenesis. *Prev. Vet. Med.,* **102**(2), 107-111. (2011). DOI:10.1016/j.prevetmed.2011.04.005.

12. Thrusfield, M.V., Christley, R., Brown, H., John, W. and Sons. Veterinary epidemiology. Hoboken, NJ: Wiley Blackwell; 67-80. (2018).

13. Shimshony, A. Bluetongue in Israel–a brief historical overview. *Vet. Ital,.* **40**(3), 116-118. (2004). https://www.izs.it/vet_italiana/2004/40_3/23.pdf.

14. Conraths, F.J., Gethmann, J.M., Staubach, C., Mettenleiter, T.C., Beer, M. and Hoffmann, B. Epidemiology of bluetongue virus serotype 8, Germany. *Emerg. Infect. Dis.,* **15**(3), 433-435. (2009). DOI:10.3201/eid1503.081210.

15. Katsoulos, P.D., Giadinis, N.D., Chaintoutis, S.C., Dovas, C.I., Kiossis, E., Tsousis, G., Psychas, V., Vlemmas, I., Papadopoulos, T., Papadopoulos, O., Zientara, S., Karatzias, H. and Boscos, C. Epidemiological characteristics and clinicopathological features of bluetongue in sheep and cattle, during the 2014 BTV serotype 4 incursion in Greece. *Trop. Anim. Health. Prod.,* **48**(3), 469-477 (2016). DOI:10.1007/s11250-015-0974-5.

16. Carvelli, A., Sala, M., Autorino, G.L., Scicluna, M.T., Iacoponi, F., Rombola, P. and Scaramozzino, P. A cross-sectional serosurvey in a sheep population in central Italy following a bluetongue epidemic. *PloS. One.,* **14**(1), e0208074. (2019). DOI:10.1371/journal.pone.0208074.

17. Brenner, J., Oura, C., Asis, I., Maan, S., Elad, D., Maan, N., Friedgut, O., Nomikou, K., Rotenberg, D., Bumbarov, V., Mertens, P., Yadin, H. and Batten, C. Multiple serotypes of bluetongue virus in sheep and cattle, Israel. *Emerg. Infect. Dis.,* **16**(12), 2003-2004 (2010). DOI:10.3201/eid1612.100239.

18. Mellor, P.S., Carpenter, S., Harrup, L., Baylis, M. and Mertens, P.P. Bluetongue in Europe and the Mediterranean Basin: history of occurrence prior to 2006. *Prev. Vet. Med.,* **87**(1-2), 4-20. (2008). DOI:10.1016/j.prevetmed.2008.06.002.

19. Yang, H., Xiao, L., Wang, J., Meng, J., Lv, M., Liao, D., Song, J., Gao, L., Xiong, H., He, Y., Niu, B., Chuang, X. and Li, H. Phylogenetic Characterization Genome Segment 2 of Bluetongue Virus Strains Belonging to Serotypes 5, 7 and 24 Isolated for the First Time in China During 2012 to 2014. *Transbound. Emerg. Dis.,* **64**(4), 1317-1321(2017). DOI:10.1111/tbed.12479.

20. El Hage, J., Lorusso, A., Carmine, I., Di Gennaro, A., Portanti, O., Olivieri, S., Casaccia, C., Pisciella, M., Teodori, L., Sghaier, S. and Savini, G. Bluetongue virus in Lebanon. *Transbound. Emerg. Dis.,* **60**(5), 390-394 (2013). DOI:10.1111/tbed.12126.

21. Shahin, M. Climate of the Arab Region. Water Resources and Hydrometeorology of the Arab Region. Dordrecht: Springer Netherlands. pp. 77-134. (2007).

22. Palestinian Central Bureau of Statistics. Livestock Survey, 2013 - Main Results. (2014). http://www.pcbs.gov.ps/Downloads/book2042.pdf.

23. 23- Mayo, C., Mullens, B., Gibbs, E.P. and MacLachlan, N.J. Overwintering of Bluetongue virus in temperate zones. *Vet. Ital.,* **52**(3-4), 243-246 (2016). DOI:10.12834/VetIt.521.2473.3.

24. Maclachlan, N.J. and Mayo, C.E. Potential strategies for control of bluetongue, a globally emerging, Culicoides-transmitted viral disease of ruminant livestock and wildlife. *Antiviral. Res.,* **99**(2), 79-90 (2013). DOI:10.1016/j.antiviral.2013.04.021.

25. Brand, S.P. and Keeling, M.J. The impact of temperature changes on vector-borne disease transmission: Culicoides midges and bluetongue virus. *J. R. Soc. Interface.,* **14**(128), 20160481, pages 1-13 (2017). DOI:10.1098/rsif.2016.0481.

26. Wittmann, E.J. and Baylis, M. Climate change: effects on culicoides--transmitted viruses and implications for the UK. *Vet. J.* **160**(2), 107-117(2000). DOI:10.1053/tvjl.2000.0470.

27. Sreenivasulu, D., Subba Rao, M.V., Reddy, Y.N. and Gard, G.P. Overview of bluetongue disease, viruses, vectors, surveillance and unique features: the Indian sub-continent and adjacent regions. *Vet. Ital.,* **40**(3), 73-77. (2004). https://www.ncbi.nlm.nih.gov/pubmed/20419638.

28. 28- De Liberato, C., Purse, B.V., Goffredo, M., Scholl, F. and Scaramozzino, P. Geographical and seasonal distribution of the bluetongue virus vector, Culicoides imicola, in central Italy. *Med. Vet. Entomol.,* **17**(4), 388-394. (2003). DOI:10.1111/j.1365-2915.2003.00456.x.

29. Elbers, A.R., Backx, A., Mintiens, K., Gerbier, G., Staubach, C., Hendrickx, G. and van der Spek, A. Field observations during the Bluetongue serotype 8 epidemic in 2006. II. Morbidity and mortality rate, case fatality and clinical recovery in sheep and cattle in the Netherlands. *Prev. Vet. Med.,* **87**(1-2), 31-40. (2008). DOI:10.1016/j.prevetmed.2008.06.003

مرض اللسان الأزرق في المجترات الصغيرة في فلسطين: دراسة بأثر رجعي للفترة ٢٠٠٥-٢٠١٩

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تعتبرالمجترات الصغيرة مصدرًا مهما للدخل لكثير من الناس في جميع أنحاء العالم ، ولا سيما فقراء الريف في البلدان النامية. مرض اللسان الأزرق هو مرض معد غير معدي (بالمخالطة المباشرة) ينتقل عن طريق المفصليات و يصيب المجترات الصغيرة وله تاثيرات على الثروة الحيوانية ويؤدي لخسائر اقتصادية كبيرة في الثروة الحيوانية في فلسطين. الهدف من الدراسة الحالية هو توفيرالتحليل الوبائي لمرض اللسان الأزرق في المجترات الصغيرة في فلسطين على مدى ١٤ سنة (٢٠٠٥- ٢٠١٩). أظهرت نتائج الدراسة إلى أن المرض متوطن في فلسطين في الفترة ٢٠٠٩-٢٠١٩. تم توثيق ما مجموعه ٢٧٣ حالة تفشي تشمل ١٦٢٨ حالة أسفرت عن ٣٥١ حالة وفاة. وبلغ معدل الإصابة ٥,٥٪ ، ومتوسط معدل الوفيات ١,٦٪. وتراوحت نسبة إماتة الحالات من ٠,٠٪ إلى ٣٩,٢٩٪ بمتوسط ٢٠,٢٪. لا يوجد تحصين للمرض في فلسطين. كما أظهر التحليل الزمني أن اللسان الازرق أكثر ظهورا في موسم درجات الحرارة المنخفضة بين شهري ايلول و كانون الاول، مع ذروة أعلى في تشرين الثاني. تم تسجيل ما لا يقل عن خمسة أنماط مصلية من ٢-٤-٥-٦-٨ كانت موجودة بشكل مستمر في فلسطين. تم تسجيل أنماط مصلية متعددة في نفس فترة تفشي المرض مما يزيد من خطر إعادة التشكيل والتجمع الجيني للفيروس. ان تسجيل البيانات الفعال، وتعزيز وعي اصحاب الثروة الحيوانية ، واستخدام اللقاح وبرنامج مراقبة منهجي للمرض يعد مطلبا مهما للسيطرة على المرض اوالقضاء عليه.