Bhutan Journal of Animal Science (BJAS)
Volume 6, Issue 1, Page 46-51, March 2022

DESCRIPTIVE EPIDEMIOLOGY OF THE FIRST LUMPY SKIN DISEASE OUTBREAK IN BHUTAN

SANGAY RINCHEN[1], PELDEN WANGCHUK[1], UGYEN NAMGYEL[1], SONAM PELDON[1], NK THAPA[1], SONAM JAMTSHO[2], HIRUKA MAHAT[1], PUSHPA SHARMA[1], KELZANG LHAMO[1], DECHEN WANGMO[1], KARMA WANGDI[3] AND RB GURUNG[1]

[1] National Centre for Animal Health, Department of Livestock, Ministry of Agriculture and Forests
[2] Thromde Veterinary Hospital, Regional Livestock Development Centre, Department of Livestock, Ministry of Agriculture and Forests
[3] Animal Health Division, Department of Livestock, Ministry of Agriculture and Forests

Author for correspondence. srinchen@moaf.gov.bt

ABSTRACT: Lumpy skin disease (LSD) is a viral disease caused by lumpy skin disease virus (LSDV), belonging to the family Poxviridae and genus Capripoxvirus. The disease is endemic in most of the African and middle eastern countries and has recently spread to the Asian nations. The first outbreak of LSD in Bhutan was confirmed on the 5th of October 2020 in tissue samples collected from cattle suffering from disease with typical signs of LSD in a district called Samtse. A survey was conducted to describe and assess the extent of outbreak and determine the probable date of virus introduction. During the October month of 2020, 79 affected households were interviewed using a structured questionnaire. The prevalence of lumpy skin disease during the survey in the affected farms ranged from 9-100%. The mean prevalence in the affected farms was 42.5% (38.07-46.91). The district (Dzongkhag) prevalence of LSD was 0.5% (0.39-0.55). The formation of nodule and wound on skin were the most commonly reported signs. The earliest onset of symptoms of LSD was on 1 July 2020. Considering the incubation period of 14-28 days, it was likely that the disease was introduced between 3 and 17 June 2020. Despite being reported for the first time, cattle owners had a fairly good knowledge and perception about the disease. As LSD is a transboundary animal disease with arthropod vectors playing role in transmission, its elimination from the country will depend on the measures undertaken in the neighboring countries of the region. Therefore, effective control and elimination of LSD requires a concerted regional approach.

Keywords: Capripoxvirus; Lumpy skin disease; transboundary,

1. INTRODUCTION

Lumpy skin disease (LSD) is caused by lumpy skin disease virus, belonging to the family Poxviridae and genus Capripoxvirus. Lumpy skin disease virus is highly host specific and causes disease only in cattle and buffaloes (Al-Salihi 2014). The transmission is mainly believed to occur through bite of vectors such as biting flies, mosquitoes and ticks (Calistri et al. 2020; Carn and Kitching 1995; Sprygin et al. 2019). Transmission can also occur mechanically through fomites and while breeding as virus is excreted through semen (Irons et al. 2005). Although the mortality rate in infected animal is low (1-5%), the morbidity rate can be as high as 20% (OIE 2017). The disease has high economic significance as it causes marked reduction in the milk yield in lactating cattle, abortion in pregnant cows and prolonged anestrous in cows. First detected in Zambia in 1929, it has gradually spread to other countries in the African continent (Davies 1991a). Until 1989, LSD was limited to African continent; however, the disease has moved outside Africa (Middle East and Madagascar) causing serious economic loss to the livestock industry (Al-Salihi 2014). Since 2012, LSD has been spreading on an unusually large scale throughout Middle Eastern countries, including Israel and Turkey, and in the latter, it is now considered endemic (EFSA 2017). In 2015,

the first outbreak of LSD was reported from Russia and there after widely distributing across the country (Sprygin et al. 2018). Gradually, the disease has spread further into Eastern Asia, with countries like China, Bangladesh and India reporting cases for the first time in 2019. In the Southeast Asian region, the first outbreak of LSD was reported in China on the 3rd of August 2019, followed by Chinese Taipei on 12th August 2019, India on 12th August 2019, Nepal on 24th June 2020 and Bangladesh on 14th July 2020 (OIE 2020).

Preparedness to prevent LSD introduction into the cattle population of Bhutan started by 23rd July 2020 upon alert by the Food and Agriculture Organization (FAO) country office of potential threat of disease introduction. On the 4th of October 2020, the National Centre for Animal Health (NCAH) received four cattle tissue samples from Samtse collected from cattle showing signs of Lumpy skin disease. Lumpy skin disease virus as the causative agent was confirmed on 5th October at the center by real-time PCR using primer forward primer- CaPV074F1 5'-AAA ACG GTA TAT GGA ATA GAG TTG GAA-3', reverse primer- CaPV074R1 5'-AAA TGA AAC CAA TGG ATG GGA TA-3' and probe CaPV074P1 5'-FAM- TGG CTC ATA GAT TTC CT-MGBNFQ-3' as described by (Bowden et al. 2008). Immediately, the NCAH sent out notification to enhance surveillance and measures to limit the spread of the disease and an advisory on LSD to be followed in infected and non-infected areas across the country. This epidemiological investigation was undertaken with the objective to describe the outbreak in Samtse, determine the spread and the probable date of disease introduction to inform the planning of further course of action.

2. MATERIALS AND METHODS

2.1 Selection of affected areas

Bhutan is administratively divided in 20 Districts (Dzongkhag) which is further subdivided into 205 sub-districts (Gewog). Several villages form a sub-district. Each district has a veterinary hospital and each sub-district has a livestock extension centre to provide animal health and extension services. After confirming the lumpy skin disease, the Dzongkhag Livestock Sector was asked to make an inventory of affected farms. Only the households that reported the cases of LSD were selected for the study.

2.2 Questionnaire survey

A questionnaire comprising four different sections was prepared and used for data collection. Section one comprised questions regarding the participants' socio-demographic information. Sections two described the details of the farm, section three gathered information on the date-wise occurrence of LSD cases on the farm, and section four on the cattle owners' knowledge and perception on LSD. The questionnaire was pretested and accordingly revised to improve clarity. Considering the ease in collection and managing data, the questions were entered in a free mobile application called Epicollect 5 within a project called "POKO NYE" (Aanensen et al. 2009). An official who had used the application previously was assigned to train the livestock officials of Dzongkhag Livestock Sector on the use of the application in collecting the data. National Centre for Animal Health being the creator of the project, could access the data that was entered remotely. All the households that reported symptoms of LSD in their cattle were interviewed. Prior to start of the interviews, the objectives of the activity were explained to the cattle owners. The interviews were conducted during the October month of 2020.

2.3 Statistical analysis

The data entered into the project were checked for completeness before analysis. As the data were collected through face-to-face interview by trained survey enumerators, there were no missing data. The data entered into the project was downloaded as .csv file (comma separated value file). Analyses were conducted using R packages "dplyr", "descr", "forcats", "ggplot2" and "lubridate" within R statistical software (R Core Team 2017; Spinu 2016; Villanueva et al. 2016; Wickham 2018; Wickham et al. 2018). Descriptive analysis was conducted for the entire dataset.

The geolocation of interview sites was collected using the Epicollect 5. The location of affected

households was plotted using Quantum GIS software (QGIS Development Team 2016). The shapefiles for the political boundary of Bhutan including district and sub-district boundaries were obtained from the National Land Commission Secretariat of Bhutan.

The on-farm prevalence of the LSD was calculated by dividing the number of animals affected by the number of animals on the farm. The prevalence in the affected farms was calculated by dividing the sum of affected animals by the total number of animals in the affected farms. The gewog level and the dzongkhag level prevalence were derived by dividing the number of cases in a particular geog/dzongkhag by the cattle population in the that geog or Dzongkhag. The cattle population of the geog and dzongkhag was used (DoL 2019).

To estimate the probable date of introduction of the virus into the community, the incubation period range of 14-28 days was used (EFSA 2015). The probable date of introduction was estimated by subtracting incubation period from the date of the first recorded onset of symptoms.

3. RESULTS AND DISCUSSION

In total, 79 individuals (27 females and 52 males) were interviewed (one each from the affected household). The mean age of the respondent was 49.35 years (19-93). The mean age of the female respondent was 46 and that of male was 51.1 years. The details on the socio-demographic characteristics of the affected farms are provided in Table 1.

During this outbreak in Samtse, a total of 152 (115 female and 37 male) cattle were affected in 79 households under 10 sub-districts (gewogs) of Samtse district (Dzongkhag). Of the affected animals, 79 (69 male and 10 female) were cross bred cattle, while 61 (36 female and 25 male) were indigenous and 12 (10 females and 2 males) pure jersey breed. Nineteen (13%) affected cattle were below one year, 35 (23%) between one to three years, 46 (30%) between 3-6 years, 27 (18%) between 6-9 years and 25 (16.4%) above 9 years. During the time of visit, 97 of the affected cattle received treatment while the rest did not. A total of 107 cattle had recovered while 43 were still sick.

Table 1: Showing the socio-demographic characteristics of the affected cattle owners

Socio-demography and farm characteristics	Categories	Frequency (%)
Gender	Male	27 (34)
	Female	52 (66)
Education level	No schooling	33 (42)
	Non formal education	3 (4)
	Primary school (less than grade 6)	19 (24)
	Monastic education	1 (1)
	Lower secondary (less than 8)	6 (8)
	Higher secondary (less than 12)	8 (10)
	Degree/masters/PhD	6 (8)
	Missing	3 (4)
Occupation	Farmer	69 (88)
	Civil Servant	4 (5)
	Military	1 (1)
	Construction worker	1 (1)
	Others	4 (5)
Type of animal shed	Concrete floor and corrugated galvanized iron (CGI) sheet roofing	54
	CGI sheet roofing but no concrete floor	14
	Thatch/plank/bamboo roof with concrete flooring	1
	Thatch/plank/bamboo roof with no concrete flooring	3
	No shed	6
	Others (tethering)	1
Are biting flies a problem	Yes	72 (92)
	No	5 (6)
	No idea	1 (1)
	Missing	1 (1)
How is it controlled	Use acaricides from LEC	78 (99)
	Missing	1 (1)

Only two had died. Based on this survey the mortality rate during the outbreak was 1.32%. The highest number of cases was reported from Yoeseltse gewog (n=84, 55%) followed by Samtse

(n=23, 15%), Sangagcholing (n=11, 7%), Norbugang (n=10,7%), Tashicholing and Ugyentse (n=8, 5%) Tading (n=4, 3%), and Namgaycholing and Dopuchen (n=1, 1%) **(**Figure 1).

Figure 1: Map of Samtse showing the coordinates of the affected households in respective gewogs

The prevalence of lumpy skin disease during the survey in the affected farms ranged from 9-100 %. The mean prevalence in the affected farms was 42.5% (38.07-46.91). The Dzongkhag prevalence of LSD was 0.5% (0.39-0.55%). Since the report of first outbreak in India in August 2019, the disease was reported widely from other states of India (Vora and Kulkarni 2020). Bhutan shares a long porous border with north-eastern Indian states of Assam and West Bengal in the south, Arunachal Pradesh in the east and Sikkim in the west. The contiguous and porous land border with settlement along the border facilitates movement of animals across the border for grazing and sometimes trade, although the latter is strictly regulated. As LSD was rampantly spreading in India and the outbreak in Bhutan was reported from the district that shares border in the Indian state of West Bengal, we assume that the introduction must have occurred from the neighboring states of India. In the subsequent month, LSD was also reported from border districts like Samdrup Jongkhar, Dagana and Sarpang.

The disease in cattle was presented with single or combination of more than one clinical sign. Other than skin nodules and wounds on skin, signs such fever, lameness, diarrhea, salivation, loss of milk production and decrease in milk production were reported in combination with other clinical sign. The formation of nodule (n=72) and wound on the skin (n=56) were the most commonly reported signs followed by fever (n=47), loss of appetite (n=35), decreased milk production (n=18), lameness (n=17), salivation (n=15) and diarrhea (n=3) (Figure 2)**.** The most commonly reported signs of the disease during this outbreak were consistent as reported elsewhere (Sameea Yousefi et al. 2017). The mortality rate was low (1.3%) conforming to the existing knowledge about the disease (Davies 1991b); however, the economic impact of the outbreak must have been severe on the marginal cattle farmers particularly those who depend on milk production for their livelihood. As this was a rapid responsive survey carried out to assess the extent of outbreak, we didn't conduct economic impact analysis. Besides the economic impact of the disease, we consider severe compromise in animal welfare due to lameness and inability to graze resulting from development of painful lesions on limbs, oral cavity and body parts (as reported in this outbreak).

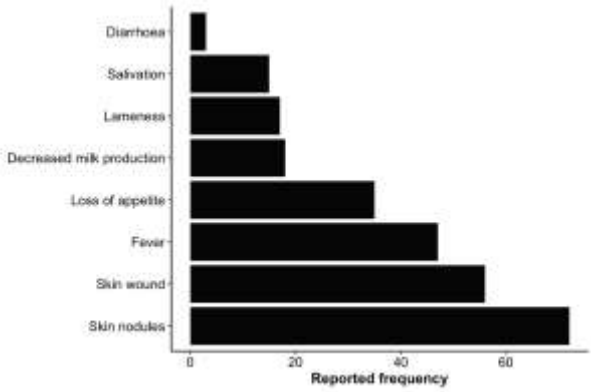

Figure 2: Showing the signs in affected animals as reported by the owners. The sum of the symptoms will add more than the number of cases because most of the cattle owners have reported more than one clinical sign.

The first onset of clinical sign could be traced back to 01 July 2020 in Dopuchen gewog **(**Figure 3**)**. Based on this information, the probable date of introduction in Dopuchen gewog could have occurred between 3 and 17 June 2020 considering the incubation period of 14-28 days. The second earliest symptom onset was reported from Sangagcholing gewog on 5 July 2020 in two cows. As the information on the onset of symptoms were collected weeks after the outbreak, we

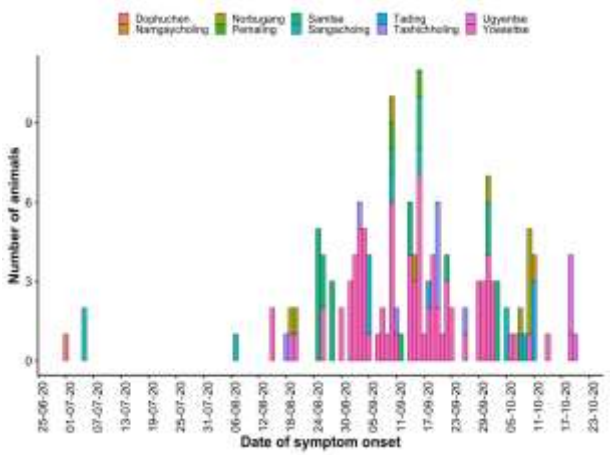

Figure 3: Epi-curve showing the first onset of clinical signs in the affected animals categorized by affected gewogs

acknowledge that recall bias must have resulted but looking at the trend of cases in the following months, we can assume that the information collected from the farmers on date of symptom onset is fairly accurate.

The disease is new to Bhutan. Therefore, only three questions were used to assess the peoples' knowledge/perception about the disease, the transmissibility to humans, the outcome of LSD infection in animals and level of concerns in their animals being infected with the disease. Of the 79 respondents, 4(5%) individuals have not responded to these three questions. Of the 75 respondents, 4(5%) reported that the LSD was zoonotic in nature and could be transmitted to humans. Thirty-two respondents (43%) reported that the disease is not zoonotic while 39 (52%) reported having no idea on this aspect of the disease. Of the 75 respondents, 5(7%) reported that LSD infected animal would die of the disease while 70 (93%) reported otherwise. Sixty-three (84%) respondents expressed being highly worried for their cattle being infected while 11 (15%) were little worried and 1 (1%) least bothered. Given that LSD is reported for the first time in the country, we expected a little to no knowledge about the disease among the cattle owners. However, only about 5% of the affected farmers provided undesirable responses to the questions used to access their knowledge about the disease. Access to animal health information has now become easy with internet facilities reaching every corner of the country, establishment of network of animal health offices, increasing number of school-going children and increasing literacy rate. As the outbreak was going on for some time, we assume the cattle owners would have learned about the disease from any of these information sources. Nevertheless, it is important that education programs are planned and carried out to disseminate accurate and relevant information.

4. CONCLUSIONS & RECOMMENDATION

LSD is a livestock disease of economic importance that has rapidly spread across the world. We report the first outbreak of LSD in Bhutan. Since it is a transboundary animal disease with arthropod vectors playing role in transmission, elimination of the disease from the country will be highly dependent on the measures under taken in the neighboring endemic countries in the region. Therefore, effective control and elimination of LSD requires a concerted regional approach.

Acknowledgements

We are grateful to the Department of Livestock, for the support and guidance. We thank Regional Livestock Development Centre, Tsimasham and Dzongkhag Livestock Sector-Samtse for supporting in data collection and managing the outbreak.

REFERENCES

Aanensen DM, Huntley DM, Feil EJ, al-Own, F and Spratt BG. (2009). EpiCollect: linking smartphones to web applications for epidemiology, ecology and community data collection. PLoS One, 4(9):e6968.

Al-Salihi K. (2014). Lumpy skin disease: Review of literature. Mirror of research in veterinary sciences and animals, 3(3):6-23.

Bowden TR, Babiuk SL, Parkyn GR, Copps JS and Boyle DB. (2008). Capripoxvirus tissue tropism and shedding: A quantitative study in experimentally infected sheep and goats. Virology, 371(2):380-393.

Calistri P, De Clercq K, Gubbins S, Klement E, Stegeman A, Cortiñas Abrahantes, J and Broglia A. (2020). Lumpy skin disease epidemiological report IV: data collection and analysis. EFSA Journal, 18(2):e06010.

Carn VM and Kitching RP. (1995). An investigation of possible routes of transmission of lumpy skin disease virus (Neethling). Epidemiol Infect, 114(1):219-226.

Davies F. (1991a). Lumpy skin disease of cattle: a growing problem in Africa and the Near East. World Animal Review, 68(3):37-42.

Davies F. (1991b). Lumpy skin disease, an African capripox virus disease of cattle. British Veterinary Journal, 147(6):489-503.

DoL. (2019). Livestock statistics. Retrieved from Thimphu: http://www.moaf.gov.bt/livestock-statistics-2019/. Accessed 26 December 2020

EFSA. (2015). Scientific Opinion on lumpy skin disease. EFSA Journal, 13(1):3986.

EFSA. (2017). Lumpy skin disease: I. Data collection and analysis. EFSA Journal, 15(4).

Irons PC, Tuppurainen ES and Venter EH. (2005). Excretion of lumpy skin disease virus in bull semen. Theriogenology, 63(5):1290-1297.

OIE. (2017). Lumpy Skin Disease. Retrieved from https://www.oie.int/fileadmin/Home/eng/Animal_Health_in_the_World/docs/pdf/Disease_cards/LUMPY_SKIN_DISEASE.pdf Accessed 26 December 2020

OIE. (2020). Lumpy Skin Disease (LSD). Retrieved from https://rr-asia.oie.int/en/projects/lumpy-skin-disease-lsd/ Accessed 26 December 2020

QGIS Development Team. (2016). QGIS geographic information system. Open source geospatial foundation project.

R Core Team. (2017). R Core Team (2017). R: A language and environment for statistical computing. R Found. Stat. Comput. Vienna, Austria.

Sameea Yousefi P, Mardani K, Dalir-Naghadeh B and Jalilzadeh-Amin G. (2017). Epidemiological Study of Lumpy Skin Disease Outbreaks in North-western Iran. Transbound Emerg Dis, 64(6):1782-1789.

Spinu MV. (2016). Package 'lubridate'. In: Recuperado el.

Sprygin A, Artyuchova E, Babin Y, Prutnikov P, Kostrova E, Byadovskaya O and Kononov A. (2018). Epidemiological characterization of lumpy skin disease outbreaks in Russia in 2016. Transboundary and emerging diseases, 65(6): 1514-1521.

Sprygin A, Pestova Y, Wallace DB, Tuppurainen E and Kononov AV. (2019). Transmission of lumpy skin disease virus: A short review. Virus Res, 269, 197637.

Villanueva R, Chen Z and Wickham H. (2016). ggplot2: elegant graphics for data analysis using the grammar of graphics. In: Springer-Verlag, New York, NY.

Vora R and Kulkarni V. (2020). Lumpy skin disease becomes worst nightmare for farmers in a dozen States. The Hindu. Retrieved from https://www.thehindubusinessline.com/economy/agri-business/lumpy-skin-disease-becomes-worst-nightmare-for-farmers-in-a-dozen-states/article32841121.ece Accessed 03 January 2021

Wickham H. (2018). Forcats: Tools for working with categorical variables (factors). R package version 0.3. 0.

Wickham H, François R, Henry L and Müller K. (2018). Dplyr: A grammar of data manipulation (R package version 0.7. 6)[Computer software].