Assessment of Lumpy Skin Disease prevalence in cattle: insights from a regional outbreak

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Abstract

In a study on prevalence of LSD in Andhra Pradesh it was noticed that 45 out of 81 cattle were affected with an overall prevalence of 55.56%. The sample collection and data were recorded from ten districts of Andhra Pradesh. In the present study, skin scabs were collected from cattle affected with LSD were processed for DNA extraction and were amplified for F gene of LSDV using specific primers. The highest prevalence was recorded in Guntur district of Andhra Pradesh while the lowest was in Visakhapatnam. The prevalence of LSD and mortality was recorded highest in calves of 3-6 months age (70.73% & 63.4%), followed by cattle aged 6 months to 2 years (47.6% & 14.28%) and cattle aged > 2 years (31.5% & 0%). Similarly, gender wise data analysis revealed that the female cattle (67.72%) were more susceptible for the disease compared to the male ones (43.6%). Breed-wise, the highest prevalence and mortality were observed in non-descript cattle (62.9% and 51.85%, respectively), followed by Ongole, Gir, Holstein Friesian, and Jersey breeds. Seasonal trends have shown that a significant effect on the disease dynamics, with winter exhibiting the more prevalence (82.05%) and mortality (58.9%) followed by post-monsoon season (45.45% & 22.7%) and monsoon season (25% & 8.3%). The findings underscore the multifactorial nature of LSD epidemiology, influenced by geographic, demographic, and seasonal variables.

Key words: Cattle; Lumpy skin disease; PCR; Prevalence

Introduction

Lumpy skin disease (LSD) is a transboundary, vector-borne, non-zoonotic disease and is a major hazard to cattle around the world in the recent years (Gupta *et al.*, 2020). It is also known as Pseudo-urticaria, Neethling virus disease, exanthema nodularis bovis, and knopvelsiekte. The first reports of LSD were recorded in 1929 in Zambia, Africa, and the disease subsequently made its way throughout the continent (Aleksandr *et al.*, 2020 and Tuppurainen *et al.*, 2021). LSD is endemic in most of the African countries and has spread through Europe, Middle East and South Asia (Acharya and Subedi, 2020). In addition, outbreaks of LSD had been reported in China and India, as well as Bangladesh, Nepal, Bhutan, Sri Lanka and later in Vietnam and Myanmar (Lu *et al.*, 2021 and Acharya and Subedi, 2020). The first case of LSD in India was documented scientifically in the year 2020 and was expected to be emerged from the neighbouring nations (Sudhakar *et al.,* 2020). Subsequently, it spread to various states of India including Andhra Pradesh (Datten *et al.*, 2023). Prevalence of LSD is more in low lying agro-climate zone and in wet, warmer seasons because of arthropod multiplication that transmit LSDV among the cattle population (OIE, 2010).

Materials and methods

A total of 81 cattle of different age groups affected with lumpy skin (Fig 1) disease were examined from different districts of Andhra Pradesh. Scab samples (30g) on cutaneous nodules were collected from live animals using sterile scalpel and was mixed with 200µl of tissue lysis buffer after mincing. This mixture was used for extraction of nucleic acid and amplification.

The genomic DNA from cutaneous nodular lesions of lumpy skin disease affected cattle collected from different sources was extracted as per the manufacturer's protocol, using the "HiPurA® Mammalian Genomic DNA Purification Kit (Himedia). The purity and concentration of the extracted DNA sample was estimated by UV spectrophotometry (Nanodrop, M/s Thermo Scientific). The O.D. was measured at 260/280 nm and finally, the concentrations were adjusted to 100 ng/µl for molecular studies. The forward and reverse primers were used for the amplification of F gene of LSDV.

Fig 1: LSD affected Gir calf

Results and Discussion

In the present study, a total of 81 cattle suspected for Lumpy skin disease were examined based on history and clinical signs. The samples were collected from suspected cattle from different villages, cattle farms, Animal Disease Diagnostic Laboratories in different districts of Andhra Pradesh.

Prevalence

The overall prevalence of LSD in the present study was recorded as 55.56%, based on the clinical signs and lesions like pyrexia, nasal discharges, ocular discharges and small to large cutaneous nodules and molecular diagnosis. The prevalence of LSD was highest in the present study when compared to that prevalence recorded in Egypt (25.47%) by Ahmed and Zaher (2008), in Serbia (56.7%) (Manic *et al*., 2019) and in Odisha state, India (29.87% to 37.66%) (Sudhakar *et al*. 2020). However, the variation in prevalence of LSD in different countries is contributed by geographic location, climate, population levels of cattle and nutritional status (Al-Salihi, 2014).

District wise occurrence

Lumpy skin disease in cattle was recorded in ten districts of Andhra Pradesh viz. Vizianagaram, Visakhapatnam, Krishna, Guntur, Anantapuram, Sri Satya Sai, Tirupati, Kurnool, Nandyal and Chittoor (Fig 2). Out of 81 cattle examined, the highest prevalence was recorded in Guntur followed by Krishna, Chittoor, Tirupati, Kurnool, Anantapuram, Nandyal, Sri Satya Sai and Vizianagaram while the lowest was in Visakhapatnam. In line with the current results, prevalence of LSD was reported as 15.2% to 28.5% in Krishna, Prakasam, Nellore and Chittoor Districts (Lakshmi Kavitha *et al*. 2021). Similarly, 3.55% and 37.5% occurrence of LSD was reported in Bidar district, Karnataka and in Chennai, Tamil Nadu by Shilpa *et al.* (2022) and Jaferin *et al.* (2022) respectively.

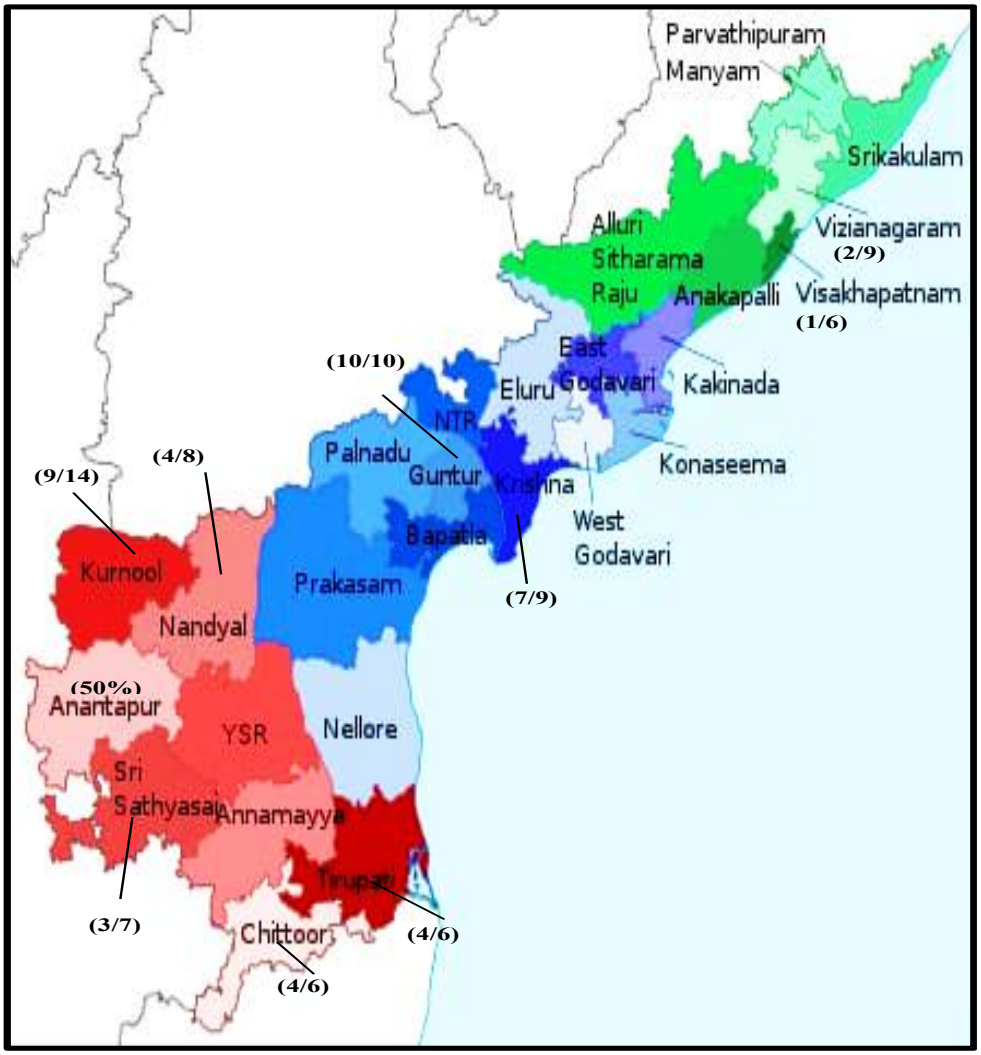

Figure 2. District wise prevalence of lumpy skin disease in cattle in Andhra Pradesh

Age

In the present study, age wise prevalence of LSD in cattle showed highest prevalence in calves of 3-6 months age (70.73%), followed by cattle aged 6 months to 2 years (47.6%) and cattle aged > 2 years (31.5%) (Fig 3). Highest mortality was recorded in calves aged 3-6 months (63.4%) followed by cattle aged 6 months to 2 years (14.28%) (Fig 3). These findings were in accordance with Ahmed and Zaher (2008) who reported highest prevalence in young calves when compared to moderate aged cattle whereas Sameea *et al.* (2017), and Sethi *et al.* (2022) reported highest prevalence in adult cattle. Highest mortality was recorded in calves aged 3-6 months (89.64%) followed by cattle aged 6 months to 2 years (30%). These findings were similar to the findings of Ahmed and Zaher (2008). Although, animals of all ages are susceptible, calves are more susceptible and develop lesions within 24 to 48 hours (Lakshmi Kavitha *et al*., 2021). The variation in prevalence of LSD in different age groups of cattle may be due to climate changes, inferior immune status and exposure to adverse stressful conditions (Ahmed and Zaher, 2008).

Gender

The prevalence was higher (67.27%) in female cattle with the mortality rate of 43.6% when compared to that in male cattle (30.76% and 19.2% respectively) (Fig 4). These findings were in accordance with the reports of Sethi *et al*. (2022) and Gharban *et al*. (2019) whereas El-Gohary *et al*. (2013) reported highest prevalence in male cattle when compared to female cattle.

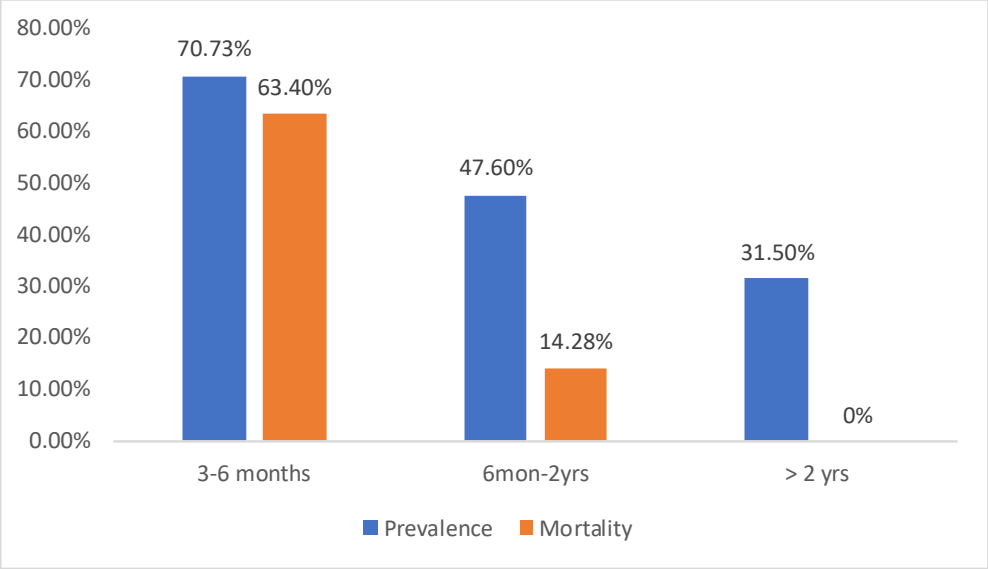

Fig 3: Age wise prevalence and mortality of LSD in cattle

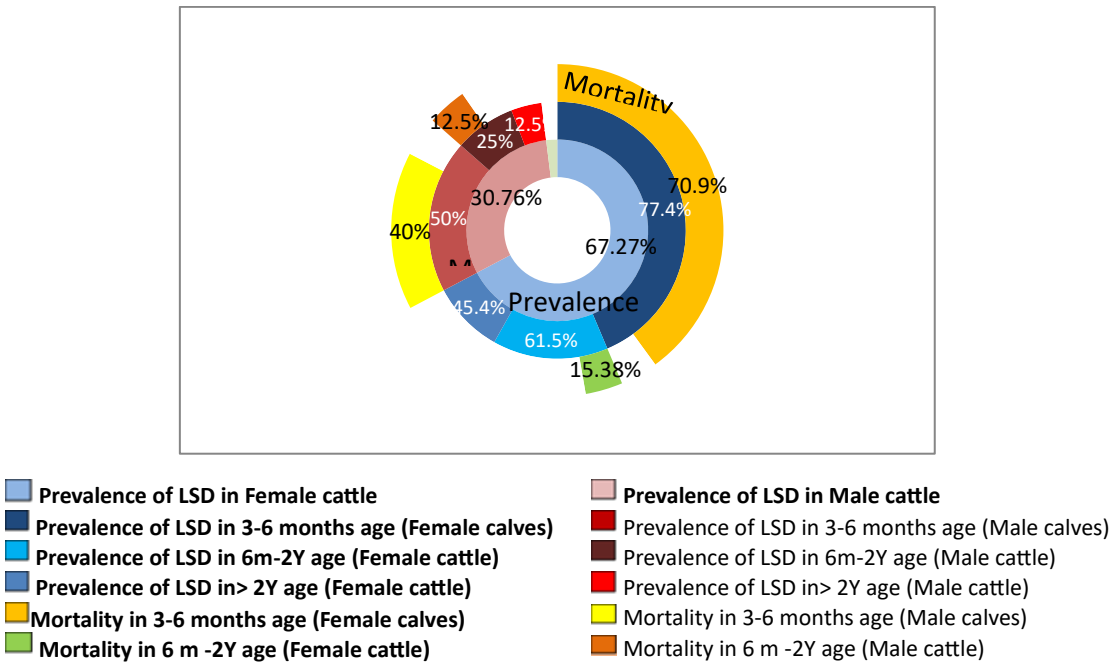

Fig 4: Gender wise prevalence and mortality of LSD in cattle

Breed

Breed wise prevalence of LSD in the present study showed highest in non-descript cattle (62.9%) followed by Ongole (58.3%), Gir (54.54%), HF (44.44%) and Jersey (40%) (Fig. 5) and the highest mortality was recorded in ND (51.85%) followed by Ongole (50%), Gir (18.1%) and HF (11.1%) breeds. These findings are in contrary with that of Sethi *et al*. (2022) who recorded highest prevalence in Holstein Friesian cattle breed/ cross bred cattle. The highest mortality was recorded in ND cattle (88.2%) followed by Ongole (85.7%), Gir (75%), HF (16.67%).

Season

Seasonal prevalence of LSD among 45 cattle in the present study was highest in the winter season (82.05%) followed by post-monsoon (45.45%), Monsoon (25%) and summer (12.5%) seasons. The highest mortality rate was during winter (58.9%) followed by post-monsoon (22.7%) and Monsoon (8.3%) seasons (Table 1). The seasonal occurrence of LSD in the present study is in accordance with the studies reported by Dubey *et al*. (2023) whereas highest prevalence was reported in summer season by Khan *et al*. (2021).

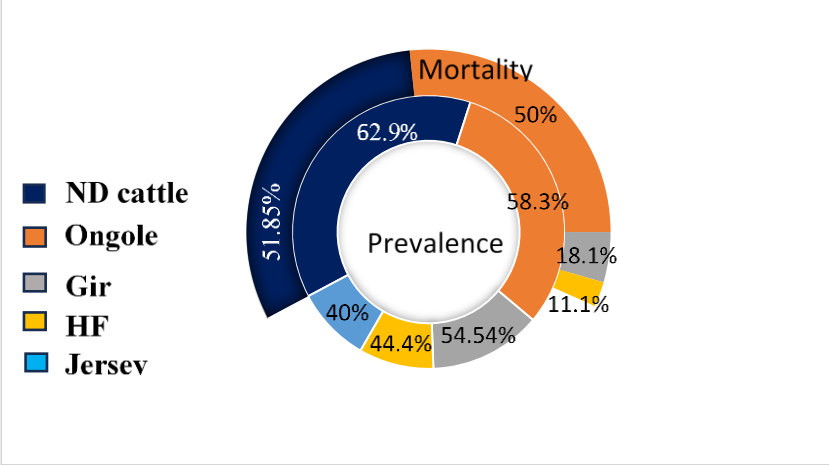

Fig 5: Breed wise prevalence of LSD in cattle

Table 1. Season wise prevalence of LSD in cattle in AP

Season	No. of cattle examined	No. of cattle affected	Prevalence	No. of animals dead	Mortality
Winter (Dec-early April)	39	32	82.05%	23	58.9%
Post monsoon (Oct to Dec)	22	10	45.45%	5	22.7%
Monsoon (June to Sep)	12	3	25%	1	8.3%
Summer (April-June)	8	1	12.5%	Nil	-
Total	**81**	**45**	**55.56%**	**29**	**35.8%**

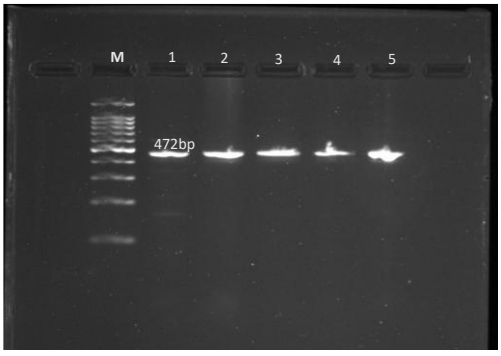

Fig 6: Agarose gel electrophoresis of amplified product of F gene of LSDV

Molecular diagnosis

In the present study, molecular diagnosis of LSD in cattle was carried out by amplification of for F gene of lumpy skin disease virus using specific primers as F- 5'ACTAGTGGATCCATGGACAGAGCTTTATCA3', R-5'GCTGCAGGAATTCTCATAGTGTTGTACTTCG3' (Sudhakar *et al.,* 2020; Gupta *et al.,* 2020). The genomic DNA extracted from skin scabs from cattle (81 cases) were used for amplification and the positive samples (45 cases) yielded expected bands. On electrophoretic analysis, amplicons of size 472bp, F gene were obtained confirming the presence of LSD viral DNA in cutaneous samples (55.56%) (Fig. 6).

Conclusion

The present case study confirms Lumpy skin disease in cattle was caused by LSDV based on PCR. In conclusion, from the current study it was observed that the highest prevalence of LSD in Andhra Pradesh was recorded in Guntur district while the lowest was in Visakhapatnam. The findings underscore the multifactorial nature of LSD epidemiology, influenced by geographic, demographic, and seasonal variables, where in the female calves of 3-6 months old were more effected and the disease was more prevalent during winter season and affecting non-descript cattle more.

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