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Poxviral diseases in animals: Rivals to farmers

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Poxviruses are large double-stranded DNA virusesspeculated to affect a vast range of animal species and often pose a significant zoonotic threat. These viruses majorly attack on skin and mucus membranes but systemic forms in various conditions of pox viral origin are also recorded. The lesions appear in the form of macules, papules, vesicles and pustules and finally become crusty before shedding. Small pox was one of the most deadly known virus of this group led huge mortality in human beings in past before the development of vaccine. The simplified classification along with disease outcome are depicted in the table No. 1 given below:

Table 1. Classification of Poxviruses along with disease outcome some of the important diseases caused by pox virus in animals

1.	**Orthopox virus**	Small pox (Variola) Vaccinia Buffalo pox (zoonotic) Camel pox Monkey pox (zoonotic) Rabbit pox Mouse pox (Ectromelia)
2.	**Capripox virus**	Sheep pox Goat pox Lumpy skin disease
3.	**Avipox virus**	Fowl pox Canary pox
4.	**Parapox virus (all are zoonotic)**	Contagious pustular dermatitis/Orf/Contagious ecthyma Bovine popular stomatitis

		Pseudocow pox (Milker's nodule)
5.	**Suipox**	Swine pox
6.	**Leporipox**	Myxomatosis in rabbits Shope fibroma in rabbits Hare fibroma
7.	**Unclassified group**	Horse pox Yaba pox Ulcerative dermatosis

Cow pox

Wild rodents are presumed to the important reservoir for the transmission of cow pox. The virus often shows affinity for prickle cell layer of the skin and the stages appears in during the pathogenesis of cow pox include Roseolar stage (congested spot) ---Papular stage----Vesicular stage---Pustular stage----finally desquamation (crusty). Buffalo pox is similar to cowpox, but reported to be little milder (Fig. 1).

Table 2. Difference between cow pox and sheep pox

Characteristics	**Cow pox**	**Sheep pox**
Nature of disease	Localized	Generalized
Fatality status	Less fatal	More fatal
Specificity	Non host specific	Host specific
Lesions	Large vesicles formation	Small vesicles formation
Sites affected	Lesions in skin mainly	Lesions on skin and other organs (Gunshot lesions)

Sheep pox

This disease is caused by Capripox virus. Merino sheep are found to be highly susceptible, while Algerian sheep resistant to the infection. This disease is highly contagious and fatal causing approximately 100% mortality in affected animals. In benign form of the infection, adult animals with skin lesions are reported, whereas malignant form is more common in lambs causes systemic form of infection involving internal organs such as lungs, kidneys, liver etc (Fig. 2). Proliferation of virus occurs in prickle cell layer of skin. The stages during its pathogenesis is similar to cow pox and other pox viruses like: Roseolar stage (congested spot) ---papular stage----vesicular stage---pustular stage----desquamation (crusty) (Hyperkeratosis+ parakeratosis+ acanthosis) (Fig. 3).

During the infection pock like lesions on skin of affected animal are seen and typical gunshot lesions on lungs/kidneys/liver are also one of the important gross finding on necropsy evaluation. In papular stage, cells increase in size and resemble to histiocytes with nuclei having marginated chromatin and large vacuole at the centre of nucleus along with intra-cytoplasmic inclusions called **Sheep pox cells/cellules**

claveleus of Borrel (characteristic cells) (sheep pox cells can be present in lungs, dermis or other organs as well).

Table 3. Difference between sheep pox and goat pox

Characteristics	**Sheep pox**	**Goat pox**
Severity	More severe	Less severe
Incubation period	Incubation period is small	Larger
Type of skin lesions	Large skin lesions	Small skin lesions
Systemic involvement	Visceral form present	rare
Zoonotic significance	Not zoonotic	Zoonotic

Lumpy skin disease (LSD)/ Bovine nodular exanthema/ Knopvelsiekte

This disease is caused by *Capripox* virus and is transmitted by vectors. This virus in affects almost all the layers of skin. The affected animals often exhibit biphasic fever. The affected animals reflect small raised nodular lesions with itchy nature on the skin. These nodules/lumps formation in skin is associated with lymphangitis and lymphadenitis of the affected portions.

Fowl pox

This is the largest virus known and even can be seen under light microscope. The inclusions formed in this disease are Intra-cytoplasmic inclusions called **Bollinger bodies** with viral particles named as**Borrel bodies**.The birds affected by fowlpox or avipox virus can show 2 forms:

- **Cutaneous form-** In this formno vesicular/exudative lesions are seen rather cytoplasm of cells become keratinized (warty nodules) (Fig. 4) unlike other mammalian pox viruses.
- **Diphtheritic form-**Exudative lesions on GIT and other visceral organs are quite appreciable in this form.

Contagious Ecthyma/Contagious Pustular Dermatitis/Orf/Sore Mouth in Goat and Sheep

Contagious Ecthyma is caused by *Parapox virus*, which can remain in the scab for 15 years. This disease is more common in goats during spring and summer seasons. This virus mainly involve oral commissure (roseolar stage (congested spot) ---papular stage----vesicular stage---pustular stage----desquamation/ crusty) and can enter to GIT and lungs. Itchy and crusty lesions usually not respond to the treatment in the affected animals. Striking epidermal hyperplasia leading to downward growth of basal layer of epidermis (unlike sheep pox) is quite predominant along with ballooning degeneration of keratinocytes and intracytoplasmicinclusions.

The infections caused by poxviruses in various animal species are not only causing harmful effects in the animals, but also leads to huge economic losses to the livestock keepers in terms of mortality and decline production. Hence, the animals must

be vaccinated for such deadly viral infections timely before the onset of detrimental havocs.

Fig. 1. Raised, nodular lumps/crusty lesions in a buffalo affected with lumpy skin disease

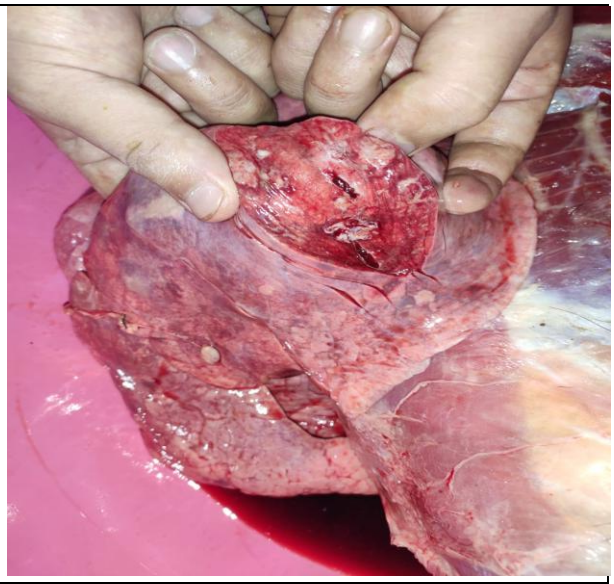

Fig. 2. Well demarcated nodular pock like lesions in the cut surface of lungs of a sheep affected with sheep pox

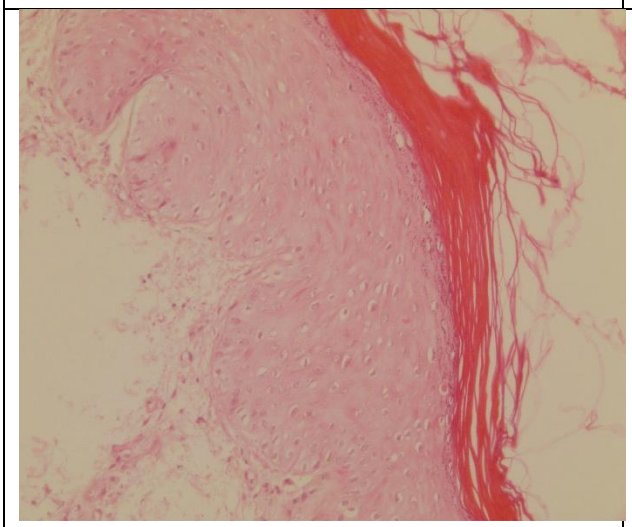

Fig. 3. Prickle cell layer of the skin showing proliferation in association with thickening of epidermal layer

Fig. 4. Crusty pock like lesions on comb and beak of the chick affected with fowl pox