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Risk factors of the introduction and spread of goat pox virus in the Republic of Chad

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Abstract

Goat pox is a highly contagious disease. The infectious agent is a virus belonging to the poxviridae family and the *Capripoxvirus* genus. This virus is resistant and can survive up to six months in dried scabs. The disease is usually spread by direct contact between healthy and sick animals because the infectious agent is found in nasal and ocular secretions through which it is eliminated. Nodules and scabs also contain large amounts of virus particles. Airborne transmission has also been observed, for example by inhalation of fumes from scabs, or indirect transmission through soiled objects/equipments or insect bites. Typical symptoms are lumps in the lips, eyes, nose, udder, genitals and the area around them. These nodules turn into vesicles, burst and form scabs. Other characteristic symptoms are fever, salivation, discharge from nose and eyes, and labored breathing. The disease exists in countries in North Africa and countries in South of the Sahara, Asia and Eastern Europe.

In the Republic of Chad, outbreaks of poxviruses have been recorded for several years. At present, their existence is no longer in doubt. Unfortunately, no in-depth study has been carried out and statistical data from the Veterinary Services are lacking. Goat pox, one of the most widespread pox viruses, appears periodically. This disease is prevalent both in the cold dry season (December, January-February) and in the hot humid season (June-July) with variable mortality. Based on bibliographic data, this manuscript summarizes the different risk factors of introduction, contamination, transmission and spread of goat pox virus.

Keywords: Virus; Goat Pox; Contamination; Transmission; Small Ruminants; Chad

1. Introduction

The Republic of Chad is a country in central Africa, without access to the sea, bordering Libya to the north, Niger to the west, Nigeria to the west-southwest, Cameroon to the south-southwest, from the Central African Republic to the south and from Sudan to the east. Geographically and culturally, the Republic of Chad is a crossing point between North Africa and sub-Saharan Africa. Covering an area of 1, 284,000 km², it is the fifth largest country in Africa, behind Sudan and Libya; the population of Chad is estimated at 14, 51, 900 [1]. The Republic of Chad is divided into three major geographical areas: from north to south, there is successively a desert region, a semi-arid space, and then the Sudanese savanna. Lake Chad, which gives the country its name, is its main body of water, and the highest point in the country is the Emi Koussi, in the Tibesti massif. The climate of Chad is of the dry tropical type characterized by two seasons: a dry season and a rainy season. The dry season is subdivided into two seasons: a hot dry season and a cold dry season [1].

In general, the economy of developing countries and that of Chad in particular, is based on agriculture and livestock; in the latter area, attention has focused primarily on cattle to the detriment of small ruminants. In Africa in general and in Chad in particular, rinderpest epidemic of 1982-1984, which decimated the cattle herd and the breeding of small

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ruminants experienced a new boom. This renewed interest is explained by the great capacity of these animals to adapt to difficult conditions and also by their socio-economic role.

In the Republic of Chad, livestock is one of the main sources of income because it generates an annual cash-flow of more than 140 billion F/CFA, an added value of 210 billion F/CFA and contributes up to 35% of Agricultural GDP. It supports 40% of the rural population and employs 80% of the working population [2]. Apart from the oil sector, it contributes between 30% and 50% of national exports [2]. This breeding is 80% dominated by mobility (transhumance). It is an extensive and mixed breeding (cattle, camels, sheep and goats). It should be noted that the transhumant livestock system favors the introduction and spread of transboundary diseases (TADs), in particular smallpox (goat and sheep pox).

Small ruminants) occupy an important place in livestock farming, especially in the Sahelian zone of Chad. According to the last general livestock census [3], the Republic of Chad has nearly 94 million head of cattle of all species, including 57 million (60.6%) of small ruminants. However, several factors limit the development of this breeding, in particular goat and sheep pox, which are two of the main priority diseases indicated on the list of diseases monitored by the animal disease epidemiological surveillance network in the Republic of Chad [4]. Although this disease represents the most important pathological dominant of goat breeding in Chad, no concrete prophylactic action is undertaken by the State to eradicate it. It should also be noted that among the diseases that threaten small ruminant livestock in Chad, poxviruses have been frequently observed [5]. Around the years 1970-1976, it was sheep pox that we encountered in the field. But since 1985, sheep pox has been eclipsed in favor of goat pox.

Indeed, goat pox is a highly contagious disease; it is caused by a virus belonging to the poxviridae family and the *Capri poxvirus* genus. This virus is resistant and can survive up to six months in dried scabs. The disease is generally spread by direct contact between healthy and sick animals because the infectious agent is found in the nasal and ocular secretions by which it is eliminated. Nodules and scabs also contain large amounts of viral particles. Transmission is also made through the air, for example by inhalation of fumes from scabs or indirect transmission through soiled objects/equipments or insect bites.

Typical symptoms of the disease are lumps in the lips, eyes, nose, udder, genitals and the area around them. These nodules turn into vesicles, burst and form scabs. Other characteristic symptoms are fever, salivation, discharge from nose and eyes, and labored breathing [6]. The disease exists in the countries of North and southern Saharan Africa, Asia and Eastern Europe. In recent years, outbreaks have occurred in Turkey, Greece and Bulgaria [7].

In the Republic of Chad, outbreaks of poxviruses have been recorded for several years. At present, their existence is no longer in doubt. Unfortunately, no in-depth study has been carried out and statistical data from the Veterinary Services are lacking. Goat pox, one of the most widespread poxviruses, appears periodically. This disease is prevalent both in the cold dry season (December, January-February) and in the hot, humid season (June-July) with variable mortality [8].

If the nodular form seen in Africa and India with papules evolving into nodules that leave hairless scar tissue, the moderate form can easily go unnoticed only a few lesions on the ears and tail are observed. Some authors such as Davies [9], Davies and Otema [10], Kitching et al. [11], Hadjer et al. [12] state that goat pox affects all small ruminants, while others believe that goat pox is strictly specific to goats [13; 14; 15]. However, no absolute specificity of a strain isolated in Chad could be observed experimentally, as had been observed during focus studies ([7]. In the Republic of Chad, observations made between 1986 and 1988 by Bidjeh et al. [8], showed that only goats showed clinical signs of the disease).

Based on bibliographic data, the objective of this manuscript is to summarize the main factors contributing to the contamination, transmission and spread of goat pox virus in the Republic of Chad.

2. Different factors of introduction, contamination, transmission and spread of goat pox virus

There are few factors contributing to this. They are enumerated below:

2.1. Pastoralism

Mobility allows pastoralists to seek the best pastures and optimize the productivity of their herds. It is also an essential part of their business strategy. During their journey, the pastoralists are confined halfway to the outskirts of an agglomeration where they can find water and pasture. At this level, their animals mix with those of the agglomeration, which constitutes a source of contamination.

Indeed, pastoralism or the extensive use of collective rangelands for livestock breeding represents an essential cultural and economic way of life that concerns between 100 and 200 million people in the world. In sub-Saharan Africa, about 16% of the population depends on pastoralism, and in some countries pastoral populations constitute the majority of the population. Although pastoral systems show great diversity, they are often characterized by low population density, high mobility and dynamism of complex information systems and a high dependence on local knowledge. Pastoralist communities are often socially, economically and politically marginalized. However, they contribute significantly to national economy, to the achievement of development objectives and to the maintenance of goods and services of the ecosystems of collective rangelands. As users of collective rangelands dependent on the provision of many ecosystem services, such as water, food, fodder, pastoral people have a unique knowledge of how to establish and maintain balance between conservation and sustainable use.

Pastoralism supports tens of millions of people, makes the best use of arid environments and has many economic and social benefits. However, the policies followed by African countries tend to favor settled populations and marginalized pastoral communities while many of them are threatened by drought, the fragmentation of pastures, restrictions on mobility and restricted access to basic veterinary services.

2.2. Environmental factors

Animals probably become infected by rubbing against contaminated/soiled vectors.

Mechanical transmission occurs when the vector operates a simple transfer of the infectious agent from one animal to another.

2.3. Water points

Concentrated around wells or ponds, animals drink water from different sources during the year, this remains more or less a source of contamination of livestock by microbes. The risk of contamination increases considerably during the rainy season through the consumption of surface water, including at the beginning and end of the season when animals are concentrated around water points. A high density of animals whose urine and feces pollute the water constitutes disturbances, stagnant conditions for the proliferation of certain microbes, virus and parasites. Realizing this, some Chadian breeders only water their animals with half a barrel, collecting the water themselves without following the edge of the heavily polluted pond.

2.4. Pastures

Despite the advantages of pastoralism, it still faces many constraints that considerably limit development. These are:

- The degradation of natural resources due to the various cyclical droughts in the Sahel region and to strong human and animal pressures;
- The increased competition for available resources resulting in a dysfunction of traditional links between pastoralists and farmers, thus provoking recurrent sometimes deadly clashes, which is often observed in the republic of Chad;
- The extension in space and time of the duration of transhumance, which wastes enough energy, reduces animal performance and disrupts pastoralists socio-economically;
- The increased vulnerability of pastoralists, who cannot provide solutions to the crises they face.

2.5. Habitats

After grazing, the animals are taken to the village where they are kept in an open enclosure where they receive additional food in the form of concentrate (groundnut or cottonseed cake, feed, etc.) served in a half-barrel, which promotes close contact between animals, a source of transmission of microbes and virus, including goat pox virus. Sometimes, animals are kept in a closed box without window and ventilation; this is also a source of contamination of infectious diseases, and goat pox in particular.

2.6. Animal movements/Transhumance

Certain categories of breeders travel up to more than 400 km each season in search of pasture, this is a great transhumance. Transhumance is at the origin of diseases in different aspects. In addition to the stress caused by long journeys, animals spend a lot of energy, which weakens their resistance to various microbial, viral and parasitic attacks. The temporary interruption of transhumance by natural factors such as the crossing of oases and rivers, leads to

gatherings and therefore the forced proximity of herds of varied origin and gives rise to contamination by various pathogens.

2.7. Livestock markets

Animals from different horizons remain in constant contact for long days in livestock markets. Unsold animals that re-enter herds after having been in contact with others represent a major risk of contamination by various pathogens, including goat pox virus.

2.8. Husbandry practices

The farming system and ecological (climatic) factors constitute a source of contamination by the goat pox virus. The observations made by Traoré [16] show that most of the pathological problems in kids are observed during the dry season. On the other hand, the farming method and pasteurellosis entirely dominate the pathological picture in the cold season.

3. Conclusion

Goat pox is a highly contagious disease whose infectious agent is a virus belonging to the poxviridae family and the *Capripoxvirus* genus. Several factors such as: pastoralism, water points, pastures, habitats, animal movements/transhumance, livestock markets and husbandry practices, contribute to its introduction, outbreak, transmission and its spread.

One of the main routes of transmission is direct contact with infected animals, mainly in the acute phase of the disease. Airborne transmission is possible, mainly by inhalation of infected aerosols, dust particles or scab material. There is also indirect transmission through contaminated utensils/equipments or mechanical transmission through biting insects. The same strain rarely affects both species at the same time.

Goat pox is widespread disease (southern Europe, Africa, north of the Equator, the Middle East, Central Africa, the Indian sub-continent, and China).

Goat pox, one of the most widespread poxviruses, appears periodically. This disease is prevalent both in the cold dry season (December, January-February) and in the hot, humid season (June-July) with variable mortality.

Compliance with ethical standards

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Disclosure of conflict of interest

Author declares that there is no conflict of interest.

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