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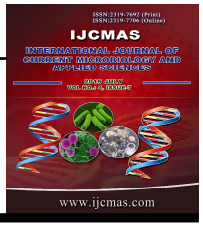

Research Article

Factors Contributing to the Introduction and the Spread of African Swine Fever Virus in Chad

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A B S T R A C T

African swine fever (ASF) is one of the most important and deadly infectious diseases of domestic and wild pigs. It is caused by a single virus of the genus *Asfarvirus* belonging to Asfarviridae family. The disease is characterized by high mortality of nearly 100%. It has either been identified or suspected in some areas of Africa namely southern Senegal, Guinea Bissau, Cape Verde, Cameroon, the Democratic Republic of Congo (DRC), Uganda, Malawi, Zambia, Angola and Mozambique. In Chad, the pig is essentially in the hands of small farmers who practice traditional way (free-living hosts). Since 2010 the pig population of Chad has experienced a death rate of nearly 60–80% due to African swine fever. African swine fever has appeared in the country for the first time in October 2010 in the city of Bongor, capital of Mayo-Kebbi-East Region, which is located about 250 km from N'Djamena. This city makes border with North Cameroon, where the disease was reported in May 2010. Despite the steps taken by the veterinary services of Chad, the disease is reported five months after in the country, and in less than four months, it has affected five regions namely Mayo-Kebbi-East, Mayo-Kebbi-West, Tandjile, Western Logone and Chari-Baguirmi. Given the role of soft ticks in the epidemiology of African swine fever in some countries, the aim of this study is to identify the factors that contributed to the introduction and spread of ASF virus Chad in order to clarify the epidemiology of the disease in this country. Administrative documents (decrees and Acts) constituted the basis of this study. The study showed that the role of wild pigs and soft ticks in this first introduction of ASF virus in Chad appeared to be unlikely. It showed that Contamination of country by ASF virus would be exogenous. Movements of animals within and across the border of the country, the delay in compensation for pig producers, the low rate of compensation for producers and ignorance by pig producers about the disease coupled sanitary measures and socio-cultural practices have contributed to the introduction and spread of ASF virus in Chad.

Introduction

Pig production in Africa contributes only less than 1% of world pig production, but it is nevertheless an invaluable importance locally for many African countries (FAO, 1995). Livestock represents one of the main sources of employment and income, as it contributes to 12% of GDP and 35% of the agricultural GDP. Livestock provides the economy of African families multiple functions such as food, economic and social functions and contributes to animal traction in agriculture and transport as source of non-human energy (Bidjeh, 2004). The quality of livestock products and compliance with international trade standards in this area are the prerequisites of the possibilities for many African producers to export their products and thus increase their income. Apart from ruminants, Chad has also monogastric animals, including pigs, which are rarely taken into account in the development projects. Despite the lack of attention given to these animals by the concerned Departments, pig farming contributes significantly to bridging the economic and food deficit of the Chadian population (Mopate *et al.*, 2011).

In the villages of the West coast and the central Africa, especially in forest areas, where cattle farming is problematic because of the presence of Tsetse flies, which are responsible of trypanosomiasis, pig is one of the main sources of animal protein. It is also used in traditional religious and cultural practices. It also acts as a source of income (mobile bank) to finance school, medical expenses and make extra expenses for buying new clothes during major events. In most of these countries, except the fish, pork is the cheapest meat on the market. It is positioned at the top of other animals in its ability to produce large quantities of high quality animal protein from lean sources of nutritional quality, such as trash man (Mopate and Koussou, 2002).

African swine fever (ASF) is one of the most important and deadly infectious diseases of domestic and wild pigs. The latter evolved in a cycle requiring the infection of wild pigs, warthogs and bush primarily (Plowright *et al.*, 1994; Anderson *et al.*, 1998; Penrith *et al.*, 2009, 2003, 2004) and soft ticks *Ornithodoros* (Kleiboeker *et al.*, 2001).

African swine fever is caused by a single virus of the genus *Asfarvirus* belonging to Asfarviridae family (Fenner, 1976; Goorha and Gramoff, 1979). African swine fever virus is diverse and includes lines, which are generally spread in separate geographical areas (Bastos *et al.*, 2003).

The introduction of domestic pigs in Southern, Central and East Africa, which began there about 500 years ago by missionaries and settlers from Europe, made a non-native species highly susceptible to ASF infection. One consequence of this introduction is that the presence of African swine fever has remained endemic in the region affecting domestic pigs (Thomson and Penrith, 2003). In some cases, soft ticks are involved in the transmission of infection (Hess, 1981). By cons, in the coastal region of West and Central Africa, there is evidence indicating that the infection persists only in domestic pigs in this vast region through a single line causing virus successive outbreaks in domestic pigs (Bastos *et al.*, 2003).

African swine fever has grown in Africa in recent years, probably due to increasing pig production in order to meet the needs of urban populations experiencing rapid population growth (FAO, 2002). It is also noteworthy that pigleft in freedom is a good

investment in what his breeding, until it is good for consumption or for sale, hardly requires inputs. However, this traditional farming system is seen as a major constraint for the control of African swine fever (Thomson and Penrith, 2003). In 1982, ASF decimated pig industry in Cameroon, where it currently is endemic (Penrith and Vosloo, 2009; FAO, 2011). The irony is that it probably comes from Europe and more precisely in the Iberian Peninsula, which was infected at the time (Bastos *et al.*, 2003). Before 1994, there were periodic reports of outbreaks by countries in Southern, Central and Eastern Africa (FAO, 2009).

African swine fever has emerged in Chad for the first time in October 2010 in the city of Bongor, capital of Mayo-Kebbi-East region, which is located about 250 km from Ndjamena. This city makes border with Cameroon north, where the disease was reported in May 2010. Despite all the sanitary measures taken by the Veterinary Authorities of Chad (Directorate of Veterinary Services-DSV), five months later, the disease is reported in the country, and in less than four months, the disease has affected five regions namely: Mayo-Kebbi-East, Mayo-Kebbi-West, Tandjile, Western Logone and Chari-Baguirmi (Fig.1).

Several authors such as Mopate *et al.* (2002; 2011), Penrith *et al.* (2009), Thomson and Penrith (2003), Couacy and Squarzoni, (2010), mentioned that pigs in freedom feeding on what they find are facing a greater degree of risk for various reasons. In regions, where the sylvatic cycle of African swine fever occurs between soft ticks and warthogs, and possibly other wild pigs; the risk of contact with natural carriers of the virus is more important (FAO, 2011).

In any outbreak, pigs in freedom are more likely to contract the virus through contact with sick pigs and carcasses of dead pigs of African swine fever (Thomson, 1985). The findings from epidemiological investigations conducted in Ivory Coast and Ghana related to the impact of African swine fever have shown that the mortality rate is high among pigs in freedom (FAO, 2011). Early detection of the emergence of African swine fever in a country must be the crucial element of any strategy to fight against this scourge. Early detection seems to depend on:

- an effective epidemiological surveillance system,
- a diagnostic laboratory well equipped with competent technicians,
- a contribution of pig producers to the control measures of the disease.

Given the role of soft ticks in the epidemiology of African swine fever in some countries, the purpose of this study is to identify the factors that contributed to the introduction and spread of ASF virus Chad in order to clarify the epidemiology of the disease in this country.

Material and Methods

Working papers

- The following documents (Decrees and Acts) have constituted the basis of this study:
- Decree n°028 / PR / PM / MERA / SG / DGDE / 136 / DSV / 2010 of 27mai 2010;
- Act n°090 /MERA/SG/ DRERA-MKE of 21 October 2010 on the limitation of areas of implementation of sanitary measures in the Regional delegation of Livestock (DRE) Mayo-Kebbi- East (MKE);
- Decision n°094/ PR/PM/MISP/ GMKE/SG/2010 from 18thOctober 2010, on the implementation of sanitary

measures in the Regional delegation of livestock of Mayo-Kebbi-East. These measures harbor on:

- The definition a perimeter of sanitary regulation in the region, where the outbreak was detected,
- the delineation of areas (infected zone, zone of protection and surveillance zone)
- the Isolation, quarantine and identification of all animals in this perimeter,
- the quarantine of infected farms the formal prohibition of entry and exit of animals in and out infected farms,
- the limitation of the movements of animals in and out of infected area,
- the temporary prohibition of fairs,
- temporary closure of the livestock markets in the infected area,
- the systematic slaughtering of sick and contact animals and disposal of carcasses,
- the disinfection or destruction of any object contaminated by sick animals,
- the prohibition of selling or given for free animals to other people any purposes either.

Results and Discussion

Husbandry pig practices

Pig farming is practiced by the poorest social strata. During the dry season, pigs are locked overnight in a pen built of local materials and remained at liberty during the day. By cons, during the rainy season, they are systematically locked to prevent them going devastate crops (Mopate and Koussou, 2002).

Pig habitat

The construction of pigsties, where they exist, depends on the financial possibilities of the breeder, know-how, availability of certain materials and the importance of his pigs. Thus, several types of pig habitat are observed: The simplest type and met everywhere consists of a small wooden hut covered with a roof and surrounded by an enclosure.

The second type of habitat that is found mostly in the South, Southeast and Southwest of Chad consists of a mud hut, round or square with a thatched part and the other part in the open. The mud is a mixture of earth and clay, also used for the construction of human dwellings (Fig.2). Apart from its economic use, it is of great interest to countries with a hot climate such as Chad, as it has very good thermal properties that did not cement: the thermal variations are much smaller and evening, heat faster decreases. The disadvantage of this material is that it is relatively fragile in the rainy season.

Sources of infection

Following the recorded abnormal mortality, the regional delegation of livestock Mayo-Kebbi- East Region, dated 25th September 2010, notified to the Directorate of Veterinary Services (DSV) a suspicion of African swine fever. Following the investigations carried out by a joint team composed of technical officers of the DSV and veterinary and zoo technical research laboratory Farcha (LRVZ), the samples were taken at the sites and sent to the National Veterinary Laboratory (LANAVET) Garoua, Cameroon for confirmation of diagnosis. Thus the presence of the ASF virus has been officially confirmed by the said laboratory on 21st October 2010. Chad has once reported African swine fever for the first time in its territory in October 22nd, 2010 (OIE, 2010). The notification was made immediately to World Organization for Animal Health (OIE), Inter-African bureau for Animal Resources of African-Union (AU/IBAR) and neighboring

countries as recommended by the World Organization for Animal Health (OIE). It was reported by the officials of the regional delegation of livestock of Bongor, two likely sources of introduction of ASF in the Mayo-Kebbi-East region: one is that the owners Bongor pig producer crossed the river (to go to Cameroon) and returned with pork he had bought at a low price. It was ASF sick and emergency slaughtered pigs for sale. This practice is known elsewhere in Africa (Couacy and Squarzoni, 2010). The second source is that certainly incubating pigs would have been brought from Cameroon at the end of a stamping out measures implemented in this country. Note also that the practice in the area of giving pigs in police families on the other side of the river in Cameroon, part of the Mayo-Kebbi-East region, which is separated from Cameroon by the Logone River. On either side of the two banks are the same people and the same families having common practices and cultures. Thus, the incubation pigs brought from Cameroon to their owners were probably the main source of introduction of the ASF virus in Chad according to the Department of Veterinary Services (DSV 2010).

Initially, two regions were infected: Mayo-Kebbi-East and Mayo-Kebbi-west. The spread of the disease in the western region is endogenous. Indeed, a trader bought at the weekly market pigs of various origins in the Mayo-Kebbi-East (near Fianga city) to supply staff cement of Bahoré (Mayo-Kebbi-West region), near City Pala. Arrived at Pala (County seat of Mayo-Kebbi-West region), the merchant finds the sick and the dead, among the animals. It gets rid of in the city of Pala. The city of Pala has been infected during the first half of November 2010 (Couacy and Squarzoni, 2010).According to the same source the disease quickly spread within both regions, because of the following:

- Pigs of the same town, although those owned different property, meet and are the main source of contamination between infected and healthy animals.
- The villages in the region are close to each other and animals in freedom can meet in the same place.
- The movement of people, sale and/or consumption of meat from sick pigs, instruments, vehicles and other bikes are an effective way of the dissemination of the disease and that, even more than the virus is very resistant in natural medium.
- Finally the lack of measures of effective bio-security, which are difficult to implement in a traditional type of pig farm.

The rapid spread of the virus in Chad demonstrates the limitations of the strategy used to control the disease. One factor promoting the rapid spread of the virus in the country seems to be the approach of the control measures used as applied elsewhere. The unusual practices and the precarious socio-economic situation of rural populations appear to speed up the spread of the disease in the country (Ban-bo *et al.*, 2012). Also, the application of stamping out has led the producers of pigs to cross the already porous borders with their pets to avoid stamping out because the accompanying measures were not followed in these operations (Ban-bo *et al.*, 2012). A common problem in all infected African countries, including Chad is to find the money to implement the stamping out in a short time, since any delay in this direction will inevitably make the uncontrollable problem, and that, in one or two weeks (Thomson and Penrith, 2003). If ASF is detected quickly and early after its introduction in a country, it should be possible to eradicate it because the number of animals involved will be small. By cons,

once the infection has grown, eradication is difficult and usually expensive. Moreover, if one attempt to eradicate once infection is widespread, it may be worse. It should be emphasized that eradication is practiced only if funds are available for compensation to compensate owners of animals slaughtered in the short term. Without compensation, widespread dissemination of animals and infected products is inevitable as producers will have the first priority to escape stamping.

Figure.1 Traditional pig's habitat

Figure.2 Free-livinghosts of infected and healthy pigs

Health monitoring

In the traditional breeding system, the health monitoring of pigs is neglected or ignored or nonexistent. The ignorance by producers of sanitary measures coupled socio-cultural practices have helped keeps homes and virus circulation in areas, where socio-economic activities are developed. The habitat soil being clay and mud wall put in trouble the decontamination of these places during the fight against the outbreak of ASF. This partly explains the fact that ASF has seen a rapid spread in the country.

The role of wild pigs and soft tick in this first introduction of ASF in Chad appears to be unlikely. Contamination of Chad by the ASF virus is exogenous. However, as described as wild pigs and soft ticks may be involved in the maintenance of the virus and thus the infection, a search of the virus in populations of wild pigs would be desirable. Movements of animals within and across the border of the country, the delay in compensation for pig producers, the low rate of compensation for farmers and ignorance by pig producers coupled sanitary measures, socio-cultural practices, have contributed to the introduction and spread of ASF virus in

the country. However, given the role of soft ticks in the epidemiology of the disease, it would be wise to undertake the research of ASF virus in wild swine and soft ticks in order to clarify the epidemiological situation of the disease in the country.

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