



Sero-prevalence and associated risk factors of peste des petits ruminants and contagious caprine pleuro-pneumonia in goats and sheep in the Southern Zone of Tanzania



Albano O. Mbyuzi^{a,*}, Erick V.G. Komba^b, Sharadhuli I. Kimera^b,
Dominic M. Kambarage^b

^a Veterinary Investigation Centre, Southern Zone, P.O. Box 186, Mtwara, Tanzania

^b Department of Veterinary Medicine and Public Health, Sokoine University of Agriculture, P.O. Box 3021, Morogoro, Tanzania

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ABSTRACT

A retrospective Sero-prevalence analysis was conducted in 2012 in order to find out whether contagious caprine pleuro-pneumonia (CCPP) and peste des petits ruminants (PPR) had already been introduced in Mtwara and Lindi regions of Southern Tanzania by 2007 and 2009. A total of 477 randomly selected sera from a bank of 3500 small ruminant samples that were collected as part of Rift Valley Fever surveillance of 2007 in Mtwara and Lindi regions were used in this study. Seroconversion was also evaluated in the 504 sera that were collected in 2009 as part of disease outbreak investigations in Tandahimba and Newala districts of Mtwara region. Seroconversions to CCPP and PPR were tested using competitive ELISA. In addition, information on different variables available in the existing surveillance forms gathered during sampling was used in the analysis of risk factors associated with seropositivity to the two diseases. The overall seroprevalence of CCPP for the sera of 2007 and 2009 in goats was 52.1% ($n = 447$) and 35.5% ($n = 434$) respectively; while in sheep the seroprevalence was 36.7% ($n = 30$) and 22.9% ($n = 70$) respectively. Seroconversion to PPR in goats and sheep was 28.7% ($n = 434$) and 35.7% ($n = 70$) respectively based on the sera of 2009. However, no antibodies were detected in the 2007 sera. Mixed infections were detected in 7.4% ($n = 434$) of the goat and 12.9% ($n = 70$) of sheep samples. Significant risk factors associated with seropositivity to CCPP in 2007 included introduction of new animals in flocks (OR = 3.94; 95% CI 1.86–8.36; $p < 0.001$) and raising animals in government farms (OR = 4.92; 95% CI 1.57–15.76; $p = 0.02$); whereas, seropositivity to CCPP in 2009 increased with introduction of new animals in flocks (OR = 18.82; 95% CI 8.06–43.96; $p < 0.001$), raising animals in government farms (OR = 4.04; 95% CI 2.69–6.42; $p < 0.001$) and raising animals in Newala district (OR = 2.35; 95% CI 1.53–3.62; $p < 0.001$). On the other hand, predictors for seropositivity to PPR in 2009 were introduction of new animals in flocks (OR = 2.83; 95% CI 1.73–4.62; $p < 0.001$) and communal grazing of animals (OR = 7.60; 95% CI 1.77–32.58; $p = 0.01$). Therefore, these results show that CCPP was already circulating in goats in the southern zone by 2007 and that PPR was probably introduced thereafter. Their presence in this emerging animal keeping area in Tanzania calls for improved surveillance and control systems.

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* Corresponding author. Tel.: +255 732 333 118; fax: +255 732 333 118; mobile: +255 754 346828/785578343/717447445.
E-mail addresses: aalomyuzi@yahoo.co.uk, alomyuzi@gmail.com (A.O. Mbyuzi).

1. Introduction

Small ruminants play a crucial role in food production in developing countries (Devendra and McLeroy, 1982), including Tanzania (Shirima, 2005). The contribution of small ruminants in household economies and livelihood in developing countries continues, however, to be constrained by factors such as high rates of infectious diseases as well as poor nutrition and marketing systems. Of the diseases, peste des petits ruminants (PPR) and contagious caprine pleuro-pneumonia (CCPP) are the most serious ones (Rurangirwa et al., 1991; Bölske et al., 1996; Singh, 2011) because of the associated high morbidity and mortality rates (Rurangirwa et al., 1987; Wesonga et al., 2004; Diallo, 2006; Singh, 2011). These two diseases pose a great threat to the livelihoods of many rural small scale ruminant keepers who are drawn from poor backgrounds (El Hassan et al., 1984; Lorenzon et al., 2002; Diallo, 2006).

PPR is transmitted through inhalation and direct contact with ocular/nasal secretions, faeces and contaminated water and feeds (Saliki et al., 1993); while CCPP is transmitted mainly through inhalation (MacOwan and Minette, 1976). Close animal contact is therefore an important pathway in the transmission of both diseases in ruminants (Wesonga et al., 2004; Khan et al., 2008; Bahadar et al., 2009; Singh, 2011). This implies that uncontrolled animal movement partly through trading (Wesonga et al., 2004; Singh, 2011) and communal grazing may enhance sustained circulation of PPR and CCPP in the traditional farming system. In addition, stress factors due to malnutrition and movement of animals over long distances in search of water and pasture, a practice that is not uncommon in pastoral areas in sub-Saharan African countries, including Tanzania can influence PPR and CCPP infection dynamics.

PPR has been reported in a number of African countries (Diallo, 2006; Chauhan et al., 2009); in the Middle East (Chauhan et al., 2009) and Asia (Baron et al., 2011). In Tanzania, reports indicate that there was no evidence of PPR in the country before 1998 (Wambura, 2000). The disease which was confirmed in Northern Tanzania in 2008 (Swai et al., 2009; Gitao et al., 2010) and in 2011 in the Southern part of the country (Epahras et al., 2012) now appears to be widespread in the northern zone of Tanzania (Swai et al., 2009). On the other hand, CCPP, which is now confined to East and North Africa as well as in some parts of Middle East and Asia (Rurangirwa et al., 1991), is thought to have been in Tanzania since 1980s (Nyange and Mbise, 1983). This disease, which was only confirmed in 1998 (Msami et al., 1998) is now assumed to be endemic in most of goat rearing regions of Tanzania (Kusiluka et al., 2000b; Noah et al., 2011).

Studies on CCPP and PPR in Tanzania have in most cases concentrated on traditional animal keeping areas in the north, central and western parts; and yet the risk factors involved in the transmission of the two diseases have not been described. Similarly, not much has been carried out to expose the trends of the two diseases in the southern part of Tanzania, which is considered to be a non-traditional animal keeping area. The presence of CCPP and PPR in the southern part of Tanzania, which is an emerging

animal keeping area, is likely to pose a great threat to animal sectors in Mozambique and Malawi. Therefore, this study aimed at establishing whether CCPP and PPR might have been circulating in sheep and goats in the regions of southern Tanzania by 2007 and 2009.

2. Materials and methods

2.1. Data collection

This was a retrospective sero-prevalence study that was conducted in January 2013–February 2013 in order to elucidate the presence of CCPP and PPR in Lindi and Mtwara regions of southern Tanzania by the years 2007 and 2009. This was done using 981 sera that were analyzed based on the available competitive ELISA kits. This included 477 frozen sera (447 goat and 30 sheep samples) which were randomly selected from the sera bank of 3200 goat and 300 sheep samples (kept at -20°C) that were collected as part of the Rift Valley Fever (RVF) surveillance of 2007 in Tandahimba, Mtwara Rural and Masasi districts of Mtwara region and, Lindi Rural and Kilwa of Lindi region. Others (504 sera) involved all those that were collected from traditional flocks and one government farm in Tandahimba and Newala districts in Mtwara region during the disease outbreak of 2009. The two study regions had estimated populations of 592,514 goats and 28,131 sheep (VIC (Veterinary Investigation Centre), 2008). The test samples of 2007 ($n=477$) were randomly selected from each package of sera that comprised samples collected at village level. A simple random procedure using computer generated random numbers was used.

In accordance with the 2007 surveillance protocol, RVF risk wards, (the official administrative entities within a district that comprised of a number of villages) were identified and purposefully selected for the surveillance. A multistage random sampling was then used to select study villages (40) and households (400); the later which constituted the study traditional animal flocks. In each study household, 15 animals were then sampled randomly and this often comprised five samples from goats; five from sheep and the same number from cattle or consisted of 15 small ruminant sera in households which had no cattle. One government farm, which was the only farm in the sampled districts in 2007, was also included in the study.

On the other hand, all the 504 sera (475 in traditional farms and 29 in the government farm) that were collected in Tandahimba and Newala districts (Mtwara region) in 2009 were part of disease outbreak investigations that were characterized by high morbidities and mortalities, as reported by local extension staff. These reports prompted disease investigation to elucidate the disease(s) that may have been involved. Study wards, villages and subsequently flocks with history of unusual disease trends were identified and animals in each of identified flocks were randomly selected for disease investigation.

Information about species, age, sex, disease history, history of introduction of new animals, sources of animals and vaccination history for sera collected in 2007 and 2009 was gathered from the existing surveillance forms. Each serum sample was then screened against antibodies for

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