Descriptive survey of Peste des Petits Ruminants and Contagious Caprine Pleuropneumonia outbreaks in traditional goat flocks in Southern Tanzania: producers' concerns, knowledge and attitudes

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Abstract

A questionnaire-based survey was carried out in the southern part of Tanzania with the aim of evaluating the concerns and attitudes of traditional small holder small ruminant keepers in reference to Peste des Petits Ruminants (PPR) and Contagious Caprine Pleuropneumonia (CCPP) during the period of January 2013. The study involved 141 goat keepers and four randomly selected wards from a total of 30 in Tandahimba district of Mtwara region.

The results show that 91% of the respondents indicated animal diseases as the major constraint, with others reporting inadequacy of feed resources (3.30%), conflicts between crop producers and animal keepers (2.50%), poor veterinary and extension services (1.70%), water scarcity (0.80%) and thefts(0.80%) as limiting factors. Seventy three percent of livestock keepers who indicated diseases to be the major constraint identified PPR and CCPP as the most important health constraints. Other diseases of importance were helminthosis (14.0%), foot rot (8.00%) and orf (5.0%). Most livestock keepers (62.0%) indicated nasal discharge, dyspnoea, rough hair coat and coughing as the major features of PPR and CCPP. CCPP and PPR were reported to occur mainly ($p=0.00$) during the rainy than the dry season and were associated with morbidities ranging from 84.1% to 100% and mortalities varying from 64.0% to 81.0% in goats. In sheep, the morbidities ranged from 58.0% to 81.4%, while mortality range was 58.1%-74.0%.The morbidities and mortalities in goats were significantly higher ($p=0.013$) than those in sheep. The results thus indicate that smallholder small ruminant farmers in the emerging animal keeping area in the

southern part of Tanzania consider PPR and CCPP as their major limiting factors which require immediate redress in terms of improved surveillance and control measures.

Key words: *disease outbreaks, Southern Tanzania, Tandahimba district, traditional goat keepers*

Introduction

The contribution of small ruminants in rural household economies and livelihoods in sub-Saharan Africa remains limited because of constraints related to inadequacy of feed and water resources, poor animal husbandry practices, poor marketing systems and continued high burdens of infectious diseases. Of the diseases, Peste des Petits Ruminants (PPR) and Contagious Caprine Pleuro-pneumonia (CCPP) have of recent become of major concern in some countries in Africa (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). Often uncontrolled movement of animals in search of water and feeds and informal trading systems (Wesonga et al 2004; Singh, 2011) as well as communal grazing are considered as important drivers for the dynamics of CCPP and PPR in traditional areas in sub-Saharan Africa.

PPR has been reported in a number of African countries, including Tanzania (Diallo 2006; Chauhan et al 2009; Swai et al 2009; Gitao et al 2010; Epahras et al 2012). A recent sero-prevalence study in the southern part of Tanzania also revealed the presence of antibodies in sera that were collected as part of disease outbreak investigation in 2009 (Mbyuzi et al 2014). On the other hand, CCPP, which is thought to have been in Tanzania since the 1980s (Nyange and Mbise 1983) and confirmed in 1998 (Msami et al 1998), has assumed an endemic status in most goat rearing regions of the country (Kusiluka et al 2000b; Noah et al 2011). A retrospective serological survey done on sera collected as part of Rift Valley Fever (RVF) surveillance of 2007 also showed the presence of CCPP in small ruminants in the southern part of Tanzania (Mbyuzi et al 2014).

The presence of CCPP and PPR in the southern part of Tanzania is likely to pose a serious threat to the livelihood of the resource poor animal keepers in this emerging animal keeping zone as well as the animal sectors in countries such as Mozambique and Malawi because of cross border movement of animals. Therefore, the purpose of this study was to carry out a descriptive survey to evaluate the small ruminants keepers' concerns, knowledge and attitudes toward CCPP and PPR, which are most feared trans-boundary animal diseases in the small ruminant traditional farming sector (FAO 1999; Kusiluka et al 2000b;Wesonga et al 2004; Epaphras et al 2012) with the view of identifying entry points for their engagement in participatory disease surveillance and control systems.

Materials and Methods

Study area and sampling procedure

The study was conducted in January 2013 in four randomly selected wards in Tandahimba district that had 30 wards. The district experiences a humid and hotter wet season in November to May period and a cool and less humid dry season in June to October, with mean annual rainfall that ranges from 800 mm to 1,200 mm. This particular district was purposively chosen because it had the highest number of small ruminant population in southern Tanzania. The choice was also based on the existence of reports of unusual disease trends in 2009 and thereafter (Fig. 1). A systematic random sampling procedure was used to select 200 animal keepers who served as respondents from

amongst 607 smallholder farmers from four wards based on the standard formula i.e. n = DE [Pa (1-Pa)]/ $(SEPa)^2$ where: n was the sample size; DE was the design effect which was estimated to be 2 (Salganik 2006); Pa was the proportion of respondents who would report disease outbreaks; -Pa constituted the proportion of those who would not have reported disease outbreak ever since 2009; SEPa was the desired level of precision (standard error), which for this study was 5% while Pa was assumed at maximum probability of 50% for disease outbreak at respondent's flock level.

Data collection

The interviews were conducted by agricultural and livestock extension staffs who were trained for two days on how to administer the questionnaires and how to record responses. The training was done in distant non-study wards. During data collection the extension staff were often accompanied by researchers and dealt with a maximum of five respondents per day. Each respondent was interviewed for approximately one hour. The questionnaire that comprised questions in Kiswahili, the national language; was designed to gather information pertaining to the major constraints of small ruminant production, knowledge about the clinical features of the diseases, infection trends, seasonality of disease outbreaks and disease control measures. The gathered data were coded and entered in Microsoft excel sheet 2007 and then analyzed using Epi Info™ 7. Descriptive statistics were computed for questionnaire responses including those on disease morbidities and mortalities. Disease morbidities were computed as the number of animals contacting the disease over the total animal population from study households; whereas mortalities were computed as the number of animals dying of the disease over the total animal population from study households. Chi-square test at 95% confidence level was employed to determine statistical significance of differences between parameters. Differences were considered significant at $p \leq 0.05$. Simple linear regression was performed on data regarding disease outbreaks in different years in order to examine an association between vaccinations and disease occurrences.

Ethical statement

The study was approved by the Scientific Committee of Sokoine University of Agriculture (SUA) and permission to carry out the study in Tandahimba district was sought from the District Executive Director. Farmers' verbal consents were also instrumental in the execution of the study.

Results

Out of 200 selected small ruminant producers; 59 refused ostensibly to participate in response to a perceived failure of vaccination efforts in preventing animal losses emanating from disease outbreaks. Thus, only 141 were interviewed representing 23.2% of all producers in the study area. Ninety one percent (128/141) of respondents identified diseases as the major constraint, while others indicated inadequacy of pasture(3.30%), conflicts between crop producers and animal keepers(2.50%), poor veterinary and extension services(1.70%), water scarcity(0.80%) and theft (0.80%) as their bottlenecks. Seventy three percent (93/128) of the farmers who indicated diseases to be the major constraint identified PPR and CCPP as the most important diseases. Other diseases of importance were helminthosis (14.0%), foot rot (8.00%) and Orf (5.0%). Most livestock keepers (62.0%; 87/141) were aware of the clinical signs of CCPP and PPR; with the frequently mentioned being nasal discharge, dyspnoea, rough hair coat and coughing. Other reported clinical features were diarrhoea, stomatitis, skin nodular lesions, abortion, lameness and sudden deaths. Farmers indicated pneumonic lesions as the major pathological lesion. It was also reported that unusual

disease outbreaks, suspected to have been due to CCPP or PPR which were observed in 2009-2012 (Fig.1), occurred mainly (p=0.00) during the rainy season as compared to the dry season (Fig. 2). The reported morbidity in goats ranged from 84.1% to 100% and mortality varied from 64.0% to 81.0%. In sheep, the morbidities ranged from 58.0% to 81.4%, while mortality range was 58.1% to 74.0%.The reported morbidities and mortalities in goats were significantly higher (p=0.013) than those of sheep. It was also revealed that PPR vaccination was done in March 2011 and March 2012 with vaccination coverages of 57.0% and 71.0% of the flocks, respectively. Furthermore, it was reported that 77.0% of the farmers who vaccinated their animals in 2011 and 2012 against PPR alone reported disease outbreaks that were characterised by nasal and ocular discharges, diarrhea, stomatitis, coughing and pneumonia, skin nodules (Figure 3), rough hair coat and abortions. In contrast, farmers in Ngunja ward (90.0%; 18/20) who vaccinated their animals against both PPR and CCPP in March 2011 and repeated in March 2012 reported no serious and unusual disease trends post vaccination.

Figure 1. Annual CCPP and PPR outbreak trends in four consecutive years in the same locality as reported by
respondents and cross-checked through their records (n=141) in Tandahimba, southern Tanzania

Figure 2. Seasonal trends in disease outbreaks among goats and sheep in Tandahimba district from 2009 to 2012

Figure 3. Clinical signs and lesions of suspected PPR and CCPP in goat herds in Tandahimba district in the year 2012;

A=nasal discharge, B=diarrhea, C1=ocular and nasal discharge, C2=pneumonia, D1=sudden death, D2=pneumonia, E=nodular skin lesions, F=nasal ulcers

Discussion

This study highlights the importance of diseases as a major constraint, with PPR and CCPP being the most important ones in the emerging small ruminant farming system in the southern part of Tanzania. Notable suspected outbreaks of CCPP or PPR that occurred in 2009-2012 in Tandahimba district and mainly during the rainy season were associated with high morbidities (84.1%-100%) and mortalities (64.0% to 81.0%) in goats. High morbidities (58.0% to 81.4%) and mortalities (58.1% to 74.0%) were also experienced in sheep. The farmers' reports of CCPP and PPR in Tandahimba district further supports the results of recent reports indicating that CCPP was possibly present in the southern part of Tanzania by 2007 (Mbyuzi et al 2014); and that PPR was introduced thereafter i.e. by 2009 (Epaphras et al 2012; Mbyuzi et al 2014). This implies that CCPP and PPR, which may have been introduced into the area through movement of trade animals as well as via new settlements by pastoralists, may have since impacted immensely to the livelihoods of the resource poor animal keepers in the study district.

Most farmers (62.0%; n= 141) were aware of the clinical signs of CCPP and PPR for which nasal discharge, dyspnoea, rough hair coat and coughing were the major clinical features. They were also aware of other signs such as diarrhoea, stomatitis, skin nodular lesions, abortion, lameness and sudden deaths. However, the skin nodular lesion form which was reported in some animals may not constitute clinical signs of PPR or CCPP but rather possibly being indicative of mixed infections with goat and sheep pox. This, however, requires further investigations which will allow isolation of the etiology and engagement of molecular biological techniques to characterize the isolated etiology from such lesions.

As a coincidence, the appearance of strange nodular skin lesions which were accompanied by high case fatality helped to change meat consumers attitudes from consuming un inspected meat or even dead carcasses to demanding a public ante-mortem and postmortem examination prior to accepting purchase of meat for barbecues and from butcheries. The tendency to seek for veterinary attention was also enhanced during this time which went hand in hand with willingness to pay for veterinary services and demand for quality veterinary inputs. This was therefore a great opportunity for the veterinary authority to capitalize on the changed attitudes of farmers and consumers of goat and sheep meat. Such a dramatic desire for thorough meat inspection was important for market of slaughter animals, improved veterinary public health and control of diseases.

Attempts to control PPR involved government supported initiatives in March 2011 and March 2012 in which goat and sheep flocks were vaccinated. The vaccination coverages in the two years were 57.0% and 71.0% of the flocks, respectively. Despite this vaccination, 77.0% of the farmers in wards whose goats and sheep were vaccinated against PPR alone reported disease outbreaks that were characterised by diarrhoea, nasal and ocular discharges, skin nodules, coughing, rough hair coat, abortions and pneumonia. This brought concern to the farmers who then started condemning the vaccine. In contrast, farmers in Ngunja ward (90.0%; 18/20) who vaccinated their animals against both PPR and CCPP in March 2011 and repeated in March 2012 reported no unusual disease trends post vaccination. This could bring us to a speculation that there was involvement of both PPR and CCPP in the observed morbidities and mortalities such that control of one disease alone

could not significantly reduce the rates. It could also be speculated that continued disease outbreaks in wards whose goats and sheep were vaccinated against PPR alone could be due to CCPP. On the other hand the occurrence of a disease with clinical features suggestive of PPR in vaccinated animals may be indicative of vaccination failures possibly as a result of poor vaccine handling or vaccinating disease incubating animals. The observation could also be a result of a possible presence of mixed infections, involving CCPP, goat pox and helminthosis.

In this study, it was further observed that disease outbreaks increased with years from 2009 to 2012(R2=0.67). This, however, would not be expected in goats and sheep flocks if PPR would be mainly involved because global consensus exist on efficacy and economic benefits of the PPR vaccines due to their potential to elicit strong immune response similar to immunity produced following recovery of animals from natural infections (Diallo 2006; Baron et al 2011). It is likely that mainly CCPP new infections and unidentified disease form with nodular skin lesions could have been partly responsible for the observed disease outbreaks trend in the study areas.

Although local trading of animals was more apparent during the dry season when the economic livelihood of most people improved through sell of crops such as cashew nuts, some of the farmers sold their animals during the start of the rainy season in order to meet important family needs such as school fees and funds for purchase of agricultural inputs. It is therefore thought that the association between the rainy season and CCPP-PPR outbreaks is a result of enhanced sells of animals during the January to February period within the zone and the purchase of animals from outside to replenish stocks following increased slaughter of goats during the dry season which is coupled with a lot of festivals. Alternatively, there are fewer animals for slaughter during rainy season although the demand increases during big national festivals of X-Mass, New Year, Eid el fitr, Easter, Union day and Labours day. The presence of these huge festivals and high price of animals during rainy season attract local animal vendors to purchase animals from other goat rearing zones which are already infected and endemic for both CCPP and PPR. It is common at the expense of animal disease transmission ignorance, the new animals are kept with naive animals before they are sold and during which time local animals become terribly exposed to the risk of diseases such as CCPP and PPR infections.

Conclusions

- This study shows that small ruminant animal keepers, who traditionally were not involved in animal agriculture before, face a serious challenge from economically devastating trans-boundary diseases CCPP and PPR that are now widespread in Tanzania.

Conflict of interest statement

The authors declare that they have no any conflict of interest in relation to the study areas and research findings.

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