

1. INTRODUCTION

1.1. Problem statement and motivation

African horse sickness (AHS) is a non-contagious disease of equids which is fatal to 95% of horses infected with the virus (Coetzer & Guthrie, 2004). It is classified by the Office International des Epizooties (OIE) (see Meiswinkel *et al.*, 2004 for review) as one of the “communicable diseases with the potential for serious and rapid spread, irrespective of national borders; which are of serious socioeconomic or public health importance and which are of major importance in the international trade of animals and animal products” (Anon., 2009). AHS is endemic to sub-Saharan Africa (Coetzer & Guthrie, 2004), but occasionally outbreaks occur in other warm climates, such as Pakistan, India, Morocco, Spain and Portugal (Howell, 1960; Lubroth, 1988; Mellor, 1993). Since AHSV (African Horse Sickness Virus) and its vectors are of international concern, all aspects of the disease should be better understood.

AHS occurs periodically in endemic areas, shortly after the wet season (in some locations more regularly than in others) (Coetzer & Guthrie, 2004). Most studies thus far, have focussed on how horses become infected by AHSV, but many gaps still exist in understanding how it is maintained between seasonal outbreaks and which animals serve as part of the reservoir pool. Zebras can be infected with AHSV, but do not show any clinical symptoms (Barnard, 1998; Coetzer & Guthrie, 2004). They were therefore suspected of being involved in the maintenance of the virus in an AHS endemic area.

Although AHS is classified ‘endemic’ to Namibia (Howell, 1963) by and large, no official records exist of the disease’s presence in the arid south-western Khomas Region in particular. A total of 95% of Namibia receives rainfall of less than 500 mm/a and the mean annual rainfall is estimated at 270 mm/a (Sweet & Burke, 2000) - arid conditions, which are expected to restrict AHS occurrence. Yet unofficial reports of AHS by local farmers exist. This is surprising, since work by Conte *et al.* (2007) and as reviewed by Meiswinkel *et al.* (2004a) suggest that aridity acts as a limiting factor on the distribution of the vector (*Culicoides* midges). In addition, in the past, some farms in the south-western Khomas Region had been considered suitable for quarantine areas, as they were supposedly free of the disease, yet this no longer appears to be the case. It is feared that the disease may have been introduced by the faulty application of vaccinations (Mellor & Hamblin, 2004; Chiam *et al.*, 2009) and may not occur in the area under normal circumstances.

Suggestions that these reported cases of AHS were of an endemic source were based on evidence of AHS that has been found near the Namibian capital city, Windhoek, where 50% of donkeys assayed in the area revealed AHS antibodies present in their blood (Venter *et al.*, 1999). However, apart from these assays, and the recent work done by Scacchia *et al.*, (2009), very little is known about the state of AHS in Namibia. Data on the occurrence of *Culicoides* midges in arid areas in particular, is scant – information which is critical in the determination of whether or not AHS can be supported by natural means. This study will expand the available data on the occurrence of *Culicoides* midges in the south-western Khomas Region.

Further evidence of the occurrence of AHS in Namibia, was the temporary introduction of the disease in Spain (Lubroth, 1988; Rodriguez *et al.*, 1992) which is not an AHS endemic area. The outbreak was the result of ten zebras (*Equus burchelli*) that had been imported from Namibia. Areas such as Spain which are not endemic to AHS have no natural populations of zebra and the outbreaks appear to be isolated events, despite the presence of effective vectors in those areas. Barnard (1998) suggested that increasing zebra numbers might increase the number of AHS cases. Hartmann's mountain zebra (*Equus zebra hartmannae*) was therefore the suspected cycling host to be investigated in this study.

The presence of a vector component is needed at large enough densities for the sustained occurrence of AHS to allow for the possibility of the virus transfer. It is believed that the collective virus titre among hosts must first accumulate before AHS outbreaks can occur (Higgs & Beaty, 2005; Kuno & Chang 2005). This implies the necessity for very large numbers of the vector in an area endemic to AHS and the necessary moisture to support them.

This study has application in terms of expanding the current information on AHS in arid areas, whether or not there are enough *Culicoides* midges to maintain AHSV and whether or not there is an endemic reservoir population or infection source in the south-western Khomas Region.

The study may be useful in providing additional information for future applications in risk assessments and models to effect long-term precautionary measures against AHS. Precautionary measures, when used in conjunction with mitigation measures, could reduce occurrence of AHS.

1.2. Research Question

The research question postulated was as follows:

To what extent was AHSV maintained in the arid environment of the Khomas Region, through the distribution and abundance of its *Culicoides* vector and a possible cycling host, the Hartmann's mountain zebra (*Equus zebra hartmannae*)?

- (i) Is the Hartmann's mountain zebra (*E. z. hartmannae*) a potential cycling host in the maintenance phase of the AHS viral cycle?
- (ii) What were the distribution and abundance of possible AHS *Culicoides* vectors and their potential to sustain the AHSV transfer to hosts?

1.3. Aims

The research aims to investigate whether or not AHS is enzootic to the south-western Khomas Region by establishing the presence of the essential factors for the maintenance of AHSV.

The specific objectives were to explore:

- (i) the occurrence of *Culicoides spp.* along a rainfall gradient in Namibia
- (ii) the occurrence and migration habits of *E. z. hartmannae* in the south-western Khomas Region
- (iii) the occurrence of AHS in *E. z. hartmannae* as indicated by antibodies and viral-RNA in zebra blood and tissue samples
- (iv) the presence of viable AHSV in the blood of *E. z. hartmannae*

1.4. Hypothesis

Environmental conditions associated with the arid south-western Khomas Region significantly affected the occurrence of AHSV, as monitored in *E. z. hartmannae* populations, and its associated *Culicoides spp.* vectors.