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A SEROLOGICAL SURVEY OF FOOT-AND-MOUTH DISEASE AND BRUCELLOSIS IN SAIGA ANTELOPES IN KAZAKSTAN

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Depuis son indépendance de l'ex URSS en 1991, la république d'Asie Centrale du Kazakstan a vu l'incidence de plusieurs maladies majeures de l'élevage augmenter, sans doute à cause du manque de moyens et de vaccins. La brucellose, autrefois contrôlée par deux vaccinations annuelles de tout le bétail est réapparue, de même pour la fièvre aphteuse (F.A.)restée absente du pays 22 ans.
L'antilope saiga, espèce migratrice des steppes, peut transmettre des maladies au bétail. La brucellose y a été identifiée en 1962 et la FA en 1969 et 1974, avec de fortes mortalités. Cependant, peu de recherches avaient été faites sur ces thèmes depuis. Cet article présente une enquête sérologique récente (méthodes, résultats préliminaires) entreprise sur les saigas du désert de Betpak-Dala vis-à-vis de la brucellose et de la FA.

BACKGROUND

The saiga antelope is a migratory species found on the steppes of Central Asia. More than 80% of the total population are found in the Republic of Kazakstan. Saiga are listed in appendix 2 of CITES (Convention for International Trade in Endangered Species) due to the problems of poaching, environmental degradation and disease, which are currently threatening their future (Milner-Gulland *et al.*, 1995). The saiga range area has been eroded by human activity over the last few decades, likely resulting in more direct competition for food and water with livestock.

There are three separate populations of saiga in Kazakstan, each of which in 1994 numbered approximately 282,000 (Betpak-dala), 254,000 (Ustiurt) and 274,000 (Ural) (Bekenov *et al.*, 1998). Each population has been profitably exploited as a natural resource for many years through state regulated hunting. However, in the current climate of poor economy and high unemployment, poaching has greatly increased, mainly for the males which bear horns. Saiga horn is a profitable black-market commodity, and is exported for use in traditional Chinese medicine (Chan *et al.*, 1995).

The independence of Kazakstan from the Soviet Union in 1991 has led to major changes within industry and agriculture. Farmers, no longer bound to collective farms (which have all been privatised) are now able to move out onto the steppes. A combination of environmental degradation and increased movement of people with livestock may have a deleterious effect on the saiga population. Competition for food and water, especially in areas of desertification such as the Aral Sea region, is likely to promote further contact between saiga and livestock, possibly enhancing the risk of transmission of infectious disease between the two groups.

Foot-and-mouth disease (FMD) and pasteurellosis have been identified as two diseases that have caused major mortality in saiga in the past (Fadeev and Sludskii, 1982, Khakhin, Sedov, 1992). Brucellosis has been endemic in Kazakstan for many years. It is a disease that has been diagnosed in saiga (Rementsova, 1987) but not well researched, and it is unknown what the effects of brucellosis are on the saiga population. A mass vaccination campaign of livestock against brucellosis was launched in the Soviet Union in 1952, and reduced the overall incidence on average by 50% by 1959. In Kazakstan the number of cases of brucellosis was consistently declining prior to 1987, although a high level of incidence was recorded in some northern and eastern regions, accounting for over 50% of all the cases of brucellosis in Kazakstan (Rementsova, 1987). Since independence in 1991, brucellosis has re-emerged as a problem of the livestock population and, more importantly, of the human population of Kazakstan, possibly associated with the lack of availability and the high cost of vaccines and chemotherapeutics. If saiga are carriers of brucellosis they may play an important role in disseminating the bacteria during their migrations.

The outbreak of FMD on farms in the Shimkent area (in the south-east of Kazakstan) in March 1996 (Kitching, pers. comm.) and October 1996 proves that FMD is still a cause for concern. The origin of the outbreaks has not yet been traced, but is likely to be linked to the breakdown of vaccination programs and possibly with the increase in trade with Turkey and countries in the Middle East, where FMD is endemic.

This project aims to a) quantify the present susceptibility of saiga antelope and domestic livestock to brucellosis and foot-and-mouth disease, b) collect demographic data on the saiga antelope population, c) determine the distribution and density of domestic livestock in the saiga range area d) develop a model of the potential for intra-species and inter-species spread of foot-and-mouth disease and brucellosis through Kazakstan.

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STUDY DESIGN

There are 3 main phases to the project; a pilot study, a survey of saiga and a survey of farms. The pilot study aimed to assess the practicalities of different sample collection and storage techniques in the field. The saiga survey has two main components; data collection and interviews with hunters. In spring data will be collected from new born calves, in autumn from culled adults and juveniles during the annual hunting season. Demographic data will be collected on both occasions. Representatives from hunting co-operatives as well as individual hunters and zoologists will be surveyed to explore their knowledge of the distribution and density of saiga, and their disease status.

The farm survey will be performed along two transects through the country, one in the saiga winter range, the other in their summer range. Farms outside the saiga range area will also be included, to enable comparison. All farms along the transect route will be visited.

Survey of saiga

The 1997 field expedition (April to December) will obtain serological data from 500 new-born saiga calves in the Ustiurt population (north-west Kazakstan) in May, and from 300 culled juveniles and adults in November. Whole blood will be collected and the serum analysed for antibodies to *Brucella* sp. and FMD virus. Bacteriological swabs from the placenta of saiga calves will be taken in an attempt to identify *Brucella* organisms.

Demographic data will be collected concurrently in order to develop age and sex profiles for the saiga population and to relate this to immune status by creating an age related sero-epidemiological profile. A vital component is accurate knowledge of the age of the saiga, therefore reliable techniques for ageing saiga by dentition will be developed using a technique which involves histological examination of tooth roots and measurement of tooth wear (Reimers and Nordby, 1968, Langvatn; 1995).

Farm survey

Data collection from 500 livestock (sheep, goats, cattle, horses, camels) on farms in the saiga summer and winter ranges between Ustiurt and Almaty will take place between June and September. Animals will be stratified by species and age and 20 from each age category will be randomly selected for clinical examination and collection of whole blood. Investigators will survey the farms using a questionnaire interview. It is anticipated that a minimum of 20 farms will be visited.

IMPLEMENTATION

Pilot study

The hunting season, which normally ends 30th November to prevent interference with the rutting season, was in 1996 extended to 10th December due to organisational problems. Disturbance of saiga during the rut has in the past led to serious reproductive failure (Bannikov *et al.*, 1961). The demographic survey in May 1997 may reveal this to be the case again. Eighty-six animals were shot by the hunters from the Institute of Zoology between 25th November and 8th December 1996, all were sampled. 70 animals were shot at night using spotlights, 16 were shot during the day from a moving vehicle. Collection of whole blood from the jugular vein or carotid artery took place immediately post-mortem where possible, using plain 10ml vacutainer tubes (Beckton Dickinson). In some cases the animal was not found immediately, causing a delay of sampling and necessitating blood collection from the abdominal or thoracic cavity. Blood collected immediately post-mortem directly from the carotid artery or jugular vein gave better quality samples than those where collection was delayed, even though the maximum delay between death and sampling was 20 minutes. The sample included 52 adult females, 13 juvenile (~6 month old) females and 21 juvenile males. No adult males were sampled because the hunters did not have the appropriate licence. The government allow only 5% adult males in the total cull as a result of the low proportion of adult males in the saiga population (almost certainly a result of selective poaching of adult males for their horns).

After collection blood was left to clot at room temperature for 10-15 hours, then centrifuged (IEC MediSpin) at 2700 rpm for 10 minutes. Serum was extracted using sterile polythene 3ml pasteur pipettes and placed in sterile 2ml polypropylene biofreeze vials (Costar). A Rose Bengal Plate Test were performed on the serum before it was frozen at a temperature of about -15^{o} C. A negative and positive control (calf serum, supplied by Central Veterinary Laboratory, Weybridge) were performed at each testing to ensure the antigen was intact. Full post-mortem examinations of all culled animals were performed, and each animal was crudely condition scored (poor, average or good). The presence of parasites or gross pathological lesions were noted. Samples of both normal and diseased tissue were taken for histology.

MODEL DEVELOPMENT

A basic SIR model will be developed, using known data on disease transmission of FMD and brucellosis. Seasonality is a vital factor to consider in the model, as it influences both the density and distribution of the saiga. In April saiga congregate in groups of several thousand animals, whereas in December they are mainly organised in small "harem" herds of 50 or fewer animals.

PRELIMINARY RESULTS

Sera from all 86 animals tested negative to the Rose Bengal Plate Test (RBPT), indicating a lack of antibodies to *Brucella* sp.. However, as the RBPT is known to be less sensitive than other serological tests such as the ELISA, care must be taken in interpreting these results. The serum has not yet been tested for antibodies to FMD virus. One adult female saiga was found to be clinically diseased, with severe bronchopneumonia, generalised pleuritis and peritonitis. All other animals were clinically healthy with no gross pathological lesions obvious at post-mortem

examination. Hydatid cysts were identified in three adult females; two animals had a single cyst (one in the liver, the other in the lung) one had 7 cysts ranging in size from walnut to orange size. Hydatid cysts were not found in juvenile saiga. The condition score of animals varied significantly ($p<0.05$) according to age; juveniles were generally of poorer condition than adults.

Age category	Poor condition	Average condition	Good condition
juvenile	13 (38.2%)	16 (47.1%)	5 (14.7%)
adult	3 (5.7%)	16 (30.8%)	33 (63.5%)
Total number	16	32	38

DISCUSSION

Despite the fact that, in the immediate economic climate livestock numbers appear to be declining, saiga share pastures with domestic livestock in most regions of Kazakstan (Bekenov *et al.*, 1997). If livestock numbers revert to their long-term trend of increase or, as anticipated, the policy of liberalisation of the agricultural sector results in the distribution of farms becoming more homogeneous throughout the saiga range, then competition for pasture is likely to raise the present saiga-livestock contact rate. In any case, it is imperative that the current situation be quantified as a baseline for future comparisons. As saiga suffer many of the same infectious diseases as livestock there is always a risk of inter-species transmission. Aborting sheep can transmit brucellosis to saiga when these are housed together (Rementsova, 1987), and comparison of laboratory infection of sheep and saiga with *Brucella* revealed that saiga are more sensitive to brucellosis than sheep, retaining the causative agent for longer. Hence it is possible that saiga may become infected on pasture used by farm animals and consequently retain and carry the infection great distances as they migrate. Alternatively, it may prove unlikely that, under natural conditions, saiga will manage widespread dissemination of high concentrations of bacteria, except perhaps when they gather in vast numbers during spring calving. Fortunately saiga tend to avoid human settlements at this time. For example, there was no reported outbreak of FMD in saiga at the time of the cattle outbreaks in 1996, however this may equally be explained by the fact that the location of the outbreak, Shimkent is on the extreme of the saiga winter range area, while the outbreak occurred in the spring and autumn.

The results of this preliminary serological survey suggest that saiga antelope in the Betpak-Dala desert are unlikely to be acting as a source of brucellosis infection for domestic livestock at the present time, however the small sample size means further investigation is essential to strengthen the validity of this conclusion Perhaps more importantly, saiga cannot be excluded from a possible role as a mobile vector of disease. Certainly, the lack of research into infectious diseases of saiga means it is essential to continue to collect basic epidemiological data, most importantly to quantify susceptibility to, and prevalence of infectious disease.

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