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With 2 tables and 1 figure in the text.

The Effect of Bovine Trypanosomosis and Endo-Parasitism on Milk Production of a Dairy Farm in The White Nile State, Sudan.

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ملخص البحث

بدأ التقصي في انتشار مرض بمزرعة ألبان سكر كنانه في نوفمبر ٢٠٠٣. أظهر اختبار التكدس الدموي في الأنابيب الشعريه وجود طفيل مثقبية فايفاكس (*T. vivax*) في 23 (50%) من ٤٦ عينة دم تم جمعها من الابقار، كما وجد ان 7 (٦,٦%) من تلك الابقار مصابة بطفيل المتورقة العملاقه (*Fasciola gigantica*) تبع ذلك علاج كل القطيع ضد مرض المثقبيات بعقار إستيدرات الدايمينازين (Diminazene aceturate) بجرعة مقدارها ٣,٥ مجم/كجم. عند مراجعة المزرعة بعد ثلاثة أشهر. وجد أن ٢٣ رأساً من الابقار مصابة بمثقبية فايفاكس من أصل ٤٠٦ عينة تم فحصها، كما كانت نتيجة فحص ٨٤ عينة روث (جمعت عشوائياً) هى ٢٢(٢٠%) إصابة بالمتورقة العملاقة و٢٦(٣١%) أصابة بالايمرية و٨(٩,٥%) بالديدان الاسطوانية .*Strongyle* spp). نتيجة لذلك استخدم عقار الساموين (Isometamiduim) وطارد للديدان لعلاج كل القطيع. بعد مرور سنة. أجريت عملية مراجعة لحالة القطيع ولم تسجل فحص ٥٠ عينة جمعت عشوائيا من الدم أى حالة إصابة بمرض طفيل المثقبيات مع ملاحظة أن إنتاجية القطيع قد عادت الي معدلها الطبيعى. الجدير بالذكر ان الخسائر الناتجة من فاقد انتاج الحليب قدرت بما يعادل ١٨٠٠٠٠ دولار أمريكي.

كشف فحص عينات من تربة قنوات الري بالمنطقة عن وجود أجناس مختلفة من القواقع منها جنس ليمنيا (*Lymnaea*) وبولاينس (*Bulinus*) واللتان ثبت اصابتها بالأطوار اليرقية للمتورقة العملاقة (*Fasciola gigantica*) والمنشقة البقرية (*Schistosoma bovis*). أثبت نصب مصائد "أبسلون" للذباب عن وجود نوعين من عائلة التبانس (Tabanidae) هما أتابلوتس أجرستيس (*Atytolus agrestis*) وتبانس تينيولا (*Tabanus taeniola*) . نوقشت علاقة النتائج التي تم الحصول عليها بالظروف البيئية والمناخية ونظام سياسة القطيع في هذه المزرعة.

Summary

A serious disease problem was investigated in November 2003 at Kenana Sugar Company dairy cattle farm, The White Nile State, Sudan. Haematocrit centrifugation technique showed that 23 (50%) out of 46 cattle examined were infected with *Trypanosoma vivax.* Faecal sedimentation and floatation methods revealed that 7 (6.6%) of these animals were also infected with *Fasciola gigantica.* After mass treatment of cattle with Diminazene aceturate against trypanosomosis, a follow-up examination of a randomly selected 407 cattle, three months later, showed that 23 animals (5.4%) were still infected with *T. vivax* and faecal samples examination of 80 animals revealed that 22 (26.1%), 26 (31%) and 8 (9.5%) were suffering from *F. gigantica, Eimeria* spp. and nematodes spp. infections, respectively.

The manifestation of trypanosomosis subsided after mass treatment with Isometamidium, a fasciolicide and an anthelmentic. A year later, the farm was visited and the herd was found in a good health condition and free from *T. vivax* infection

The loss in milk production alone due to the disease outbreak was estimated at U$ 180 000.

Scoops from the edges of the irrigation canals revealed the presence of several snail genera, including *Lymnaea* and *Bulinus* which were found infected with the infective cercariae of *Fasciola gigantica* and *Schistosoma bovis,* respectively. Concurrent cattle observation and use trap of Epsilon revealed the presence of two species of *Tabanidae, Atylotus agrestis* and *Tabanus taeniola.* The results obtained are discussed in relation to the ecology, climatic conditions and system of animal husbandry practice in Kenana area.

Introduction

Animal trypanosomosis is a serious disease problem in the Sudan, within and outside the tsetse belts (Karib, 1961). Wide-spread animal trypanosomosis in Kosti and Kenana areas was reported by Uilenberg (1960). The effect of bovine trypanosomosis in peri-urban agriculture outside the tsetse belt was reported by many authors from different parts of the Sudan, (Suleiman, 1992; Abdel Salam, 1996; El Nur, 1997; Babiker, 1999). A recent and jointly conducted survey by FAO and Sudan Government has shown that the disease is spreading among dairy cattle in the White and Blue Nile States (Rahman, 2002b). With the recent expansion in dairy production and peri-urban agriculture, bovine trypanosomosis and endo-parasitism have become major constraints to milk production, and if left uncontrolled, they may lead to the collapse of the dairy industry (Rahman, 2002a).The present study reports on an outbreak of bovine trypanosomosis and fasciolosis in a big modern dairy farm in The White Nile State- Sudan.

Materials and Methods

Description of the farm:

The Kenana Company is situated on the eastern bank of The White Nile about 20 km east of Kosti town. Kenana Sugar Company produces sugar from sugar-cane which is cultivated by the same company in an area of 100,000 feddans (4200 m^2) 13N°. The sugar-cane is irrigated by passive gravity through major and minor canals network originating from The White Nile.

The company owns a dairy cattle farm which supplies the staff of the company with milk. The total herd size is 1648 head of Friesian crosses and

the indigenous kenana cattle. The daily average milk yield is about 4,500 litres.

The ecology of the area:

The sugar project is located at latitude 13^{o}N and longitudes 32^{o} 30E. The annual rainfall ranges from 200 to 400 mm. The land is a flat plain of cracking clay soil. The plant cover of the area is thorny trees of different *Acacia*, *Ziziphus* and *Balanites* spp. The dominant grasses are *Eregrostis* and *Cynchrus* spp. Small man-made forests of *Euclyptus* and Neem (*Azodirachta indica)* trees are cultivated around the sugar-canes fields. The wild life is represented by a few jackals, hyenas and gazelles. In addition, the surrounding area of the sugar scheme constitutes the rainy season grazing land of nomadic cattle of Kenana tribe. Resident cattle usually mix with the migratory cattle which come from tsetse- infested areas in The Blue Nile State (eg Khor Yabus).

The establishment of the sugar project has altered the ecology of the area. The presence of the irrigation canals network makes water surfaces available throughout the year, provides suitable breeding sites for biting flies and snails. The staff of the Sugar Company is large and composed of thousands of families living in many residential areas. Due to the availability of grass and green fodder as sugar-cane by-products, many resident people, in the project area and neighboring villages are encouraged to raise cattle. Therefore, the number of sedentary cattle in the area is increasing.

Cattle herd management:

Case history, samples collection and examination:

Dry cows are kept on separate sheds and fed on green *Sorghum vulgaris* stalks and sugar-cane shoots without any other feed supplement. Wet cows are given a balanced ration of concentrates and chopped green fodder. Piped water from a well is available *ad libitum* for both groups of animals,

Following a report of a serious disease outbreak, Kenana dairy cattle farm was visited three times by a team of the Central Veterinary Research Laboratories Centre (CVRLC). The first visit was in November 2003, the second in January 2004 followed by a third one in January 2005 to assess the herd health condition. Forty six cattle were examined during the first visit (November 2003), 407 during January 2004 and 84 during January 2005.

Random blood and faecal samples were taken from cattle of different age groups and both sexes. The blood samples were examined for

trypanosomes by Buffy coat (Murray, 1977; Woo, 1970). The faecal samples were examined by both floatation and sedimentation methods for presence of ova and oocysts. Epsilon trap was used to capture flies associated with the dairy herd. Search for snails was conducted in the irrigation canals of the farm.

Treatment trial:

The first visit revealed that cattle were infected with *T. vivax* and *Fasciolia gigantica*; the animals were therefore treated with Brenil (Diminazine aceturate) and a fasciolicide in an attempt to contain the disease outbreak. In the second visit the animals were still infected with *T. vivax* suggesting their drug-resistance to Brenil and they were thus given a strategic treatment with samorin (Isometamedin) and a fasciolicide. One year later, a follow up survey was conducted in January 2005 to assess the herd health condition. All animals were treated with Norotryp (Norbrook) at 3.9 mg/kg live b.wt and Fatrofluk (Belognal, Italy) at a dose of 10 ng/kg body weight.

Results

Health condition of the herd in November 2003:

Clinical signs of trypanosomosis started in September 2003 and within two months, the situation of the herd deteriorated. Most of the animals in the herd were emaciated. The most obvious clinical sign was loss of hair of the affected animals specially that of the tail. Total Milk production dropped from 4500 to 2250 litres per day, which amounted to about U$ 1200 daily loss. Abortion rate was 21%. In November, 23 (50%) out of the 46 cows examined were infected with *T. vivax* and seven (6.6%) with *F. gigantica*, (Table 1; 2).

During the second visit (January 2004), 23 out of 407 (5.4%) cattle were still infected with *T. vivax*, 22 (26.2%), out of 84 animals with *F. gigantica ova, 26* **(**31%) coccidial oocysts and 8 (9.5%) excreted *Strongyle ova* (Table 2).

Table 1: *Trypanosma vivax* infection rate in Kenana cattle dairy farm in relation to annual rainfall during the period 2001-2003.

Year	*T.vivax* %	Annual Rainfall(mm)
2001	0.0	312.0
2002	0.0	321.1
2003	50.0	397.8

Table 2: Parasite ova detected in faecal samples of kenana dairy cattle herd during the period 2003-2005.

Year	No. of animals examined	*T. vivax*	*F. gigantica ova*	Coccidial oocycts	*Strongyle ova*
2003	46	23(50%)	7(6.6%)	-	-
2004	407(blood)	23(5.4%)	-	-	-
	84 (faeces)		22(26.2%)	26(31%)	8(9.5%)
2005	50 blood	0 (%)			

Two hundred snails that belonged to snails from different genera (Fig. 1) were collected from Kenana irrigation canals by 35 scoops. Some of the snails were infected with cercariae of *F.giganica*. The overall infection was about 10%.

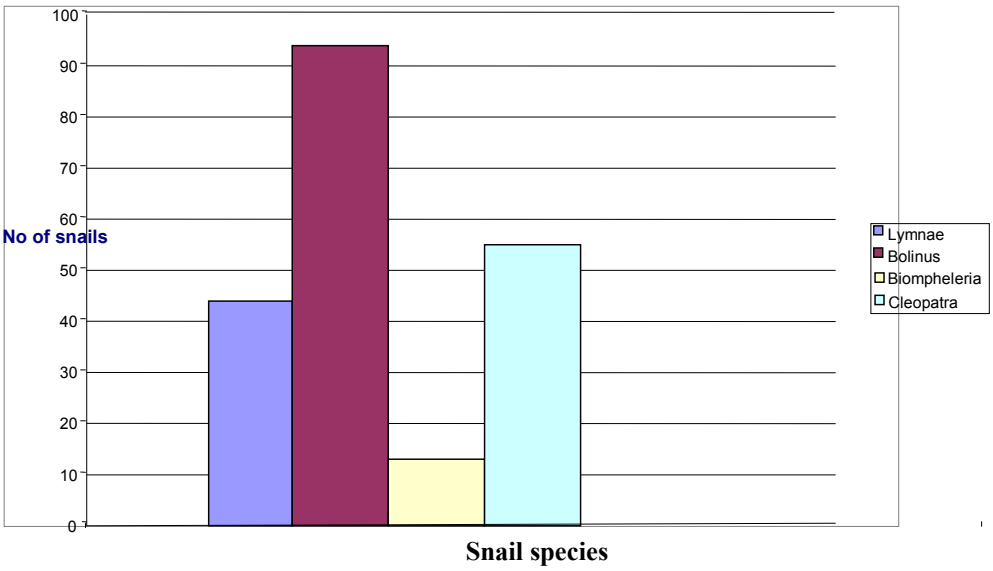

Fig. 1: Snails encountered in Kenana Sugar Cane company irrigation Agricultural

The tabanids species collected from the traps in January belong to *Atylotus agrestis* and *Tabanus taeniola.* The fly density was 3 and 7 flies/trap /day for *T. taeniola* and *A. agrestis*, respectively.

Four Month after treatment, in April 2004 the condition of the dairy herd improved and the total daily milk production was back to 4,500 litres. The total estimated loss in milk production alone during the period November /2003-April/2004 was about U$ 180,000. One year later, the herd was in a good health condition and no trypanosomes were detected in 50 animals that were randomly examined.

Discussion

The investigations reports on a serious outbreak of cattle trypanosomosis in a modern dairy cattle farm more than one thousand kilometers from the nearest tsetse belts of the Sudan. Such outbreaks are known to occur during the years of floods and heavy rainfall. In the famous flood season of the year 1946, Karib (1961) reported losses of more than 50% of Shiluk cattle due to trypanosomosis. The heavy rains and floods in Khartoum during 1988 and in Sinnar state in 1993 also were followed by serious trypanosomosis outbreaks (Musa *et al*, 1990; Rahman, 2002a).

Bovine trypanosomosis has been reported from the Kenana area (Buxton, 1955). Uilenberg (1960) reported a wide spread of *T. vivax* infection up to El Duim at latitude 14º North, yet the occurrence of the disease in this modern farm was not expected as the animals were permanently kept inside their sheds. The investigations conducted during this study shows that, some cows owned by the farm-working staff graze post-harvest products of *Sorghum vulgaris* near the enclosures of the dairy herd. These cows were found to be infected with *T. vivax*. The distance between these animals, a probable source of infection, and the dairy enclosure is only 75 metres; a reasonable distance for mechanical transmission of trypanosomoses to take place.

Rainfall in the year 2003 was comparatively higher than those in 2001 and 2002. There were also thunder storms in Kosti, Rabak and Kenana that caused problems in the irrigation canals and water from the canals flooded large areas of the cultivated land and villages around. These water surfaces were good breeding habitats for *Tabanids*. They might have led to an increase in the tabanid populations that caused the outbreak of *T. vivax* in the area. During the seasons 2001 and 2002, no floods were reported from this area and the rainfall in the two seasons was comparatively low. Therefore, trypanosomosis prevalence in these two seasons was low. Similar conditions are believed to cause the previous trypanosomosis outbreaks in Sinnar and Khartoum States (Rahman, 2002a). *Tabanids* and *Stomoxys* are known to peak during late rainy season and early dry season,

October/November, (Abdel Karim, 1980; Rahman, 2002b). Trypanosomosis outbreaks are also known to occur during this period.

Prophylaxis against trypanosomosis and endo-parasitism was recommended by Kaufmann *et al* (1992) who showed that mixed infection of *Haemonchus* and *T. congolense* resulted in severe anaemia and body weights loss. In a study conducted in Radom, Bahr Al Arab area, a cattle herd of Western Baggara eco-type, survived tsetse challenge and the high densities of tabanids and other biting flies during the rainy season, when treated prophylactically with Isometamidium and Ivermectin (Rahman, 2002a). From these results it is concluded that Bahr Al Arab area can be a suitable place for cattle production throughout the year provided that, cattle herds are strategically treated with suitable trypanocides and anthelmentics.

In the Sudan and other tropical countries, fasciolosis is caused by *F. gigantica* with a seasonal cycle of transmission in ruminants. The disease is enzootic in certain parts of the country, particularly The White Nile State The highest risk of transmission rate occurs between May and December with peak ova excretion during August/September; a period coincident with the rainy season (Goreish, 2002). The economic losses incurred by fasciolosis are well documented. This is especially true when reduced production and growth rate, chronic low-grade anaemia, emaciated carcasses and losses from condemned livers are all considered (Dargie, 1987; Eisa *et al*, 1979; Oakley *et al*, 1979).

Surveys conducted for water-borne diseases in Kenana in the last two years showed high prevalence rate of fasciolosis in cattle herds of the area (Anon, 2004). It is well known that metacercariae of Fasciola can survive on moist hay for up to eight months (Boray and Enigk, 1964). As the irrigation canals were found infested with snails infected with the cercariae stages of *F. gigantica* and *S. bovis*, the green fodder provided to the cows could have been contaminated with the infective metacercariae of *F. gigantica*, and thus caused fasciolosis in cows permanently kept in the sheds. Faecal examinations revealed no *S. bovis* infection in the dairy cattle. However, *Schistomosa* spp. infection requires direct contact between cercariae in water and their hosts.

Many tabanid species are known to breed in the same habitats of the snails (Lewis, 1953). Therefore, animals in these areas are under continuous risk of acquiring concurrent infections of *Trypanosoma*, *Fasciola*, *Schistosoma* and other parasitic infections. It could be concluded that strategic treatment with suitable trypanocides, fasciolicides, and anti-helmentics is required to minimize the risks of such outbreaks.

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