Epidemiological study of *Cryptosporidium* at the wildlife-livestock and human interface in the western boundaries of the Kruger National Park

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LA RECHERCHE AGRONOMIQUE POUR LE DÉVELOPPEMENT

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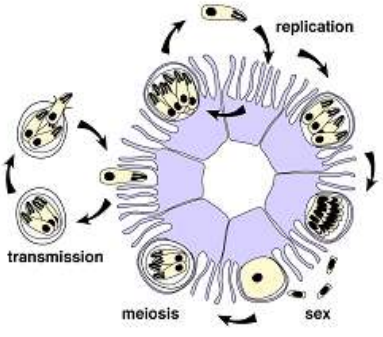
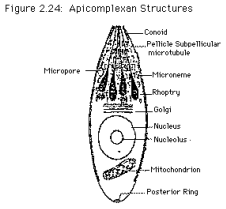
CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Cryptosporidium spp.

- Protozoan parasite
- Replicates in the small intestine of a large number of vertebrates (mammals, birds & reptiles)

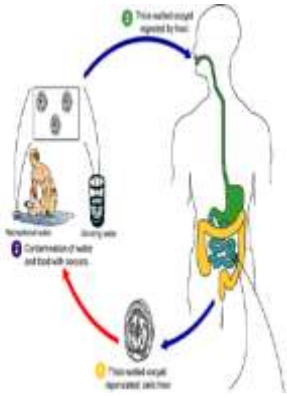




Cryptosporidium spp.

Main source of infection: contaminated environment by faeces

- Oocysts: immediately infectious when excreted
- Very stable & survive up to 6 months in a moist & cool environment
- Unaffected by chlorine or other disinfectants added to water



Cryptosporidium spp.

Phylum: *Apicomplexa*

16 species:

C. andersoni
C. baileyi
C. bovis
C. cervine*
C. canis*
C. felis*
C. galli
C. hominis*
C. melagridis*
C. molnari
C. muris*
C. parvum*
C. saurophilum
C. serpentis
C. suis*
C. wrairi

** **Cryptosporidium spp identified in human**
* **Known to be of major zoonotic importance**

Cryptosporidium spp. in humans & animals

- Significant morbidity & mortality in young & immunocompromised individuals:

  Human - among **young children** causes 45% of diarrheal deaths in Bangladesh, Brazil & in several African countries

  Human - life-threatening diahrrea in **HIV positive pateints** & therefore rural population in southern Africa with the highest prevalence of HIV/AIDS worldwide, are particularly at risk

  Livestock - important cause of diarrhoea in calves (1 -3 week); adults shed the parasite without symptoms

  Wildlife – identified as reservoirs; infection appears to be asymptomatic

Cryptosporidium spp. in humans & animals

No specific treatment available:

- Livestock - in calves quinazolina used in some europeen countries; its efficacy has not been demonstrated
- Humans – no drug effectively treats cryptospoiriosis; only reduces disease severity in some cases

Prevalences of *Cryptosporidium* in Africa

In Wildlife

Tanzania:
African Buffalo: 22%
Zebras: 28%
Wildebeest: 27%
South Africa: No data

In Livestock

Tanzania: 5.3% in calves
Uganda: 38% in calves
Zambia: 19.2% in calves
South Africa: No data

In Human

Uganda: 25% in diarrhoeic children
Guina Bissau: 7% in children
Tanzania: 17.3% in HIV patients

South Africa: 18% school children & Hospital patients (Samie et al., 2006)

Objective

- Determine the zoonotic importance of *Cryptosporidium* spp. at the wildlife, livestock & human interface in KNP
- Understand the epidemiological patterns of *Cryptosporidium* spp. among the different compartments (wildlife, livestock and human)

Research Questions

1. Are wildlife species in KNP a reservoir of *Cryptosporidium* ?
2. What is the prevalence of *Cryptosporidium* in livestock adjacent to KNP?
3. Is *Cryptosporidium* a neglected zoonosis in human communities living close to the KNP?
4. What are the epidemiological patterns of circulation and transmission of *Cryptosporidium* at the wildlife/livestock/human interface in KNP?

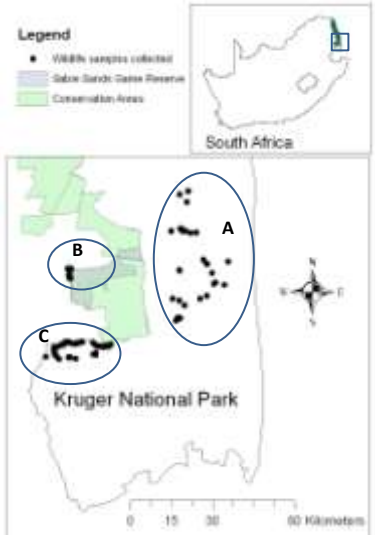
Wildlife: Study Area

Kruger National Park

Tshokwane (A), distant from KNP fence
Skukuza (C), adjacent to fence

Private game reserve

Sabi Sand (B), adjacent to fence



Wildlife: Material & Methods

Collection of faecal samples from wildlife :

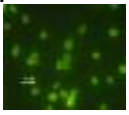
- Three of the most commonly seen species
- Colllected during dry & rainy seasons 2008/2009

	Skukuza	Sabie Sand	Tshokwane	Total
Buffalo	103	71	92	**266**
Elephant	90	76	90	**256**
Impala	98	92	90	**280**
	291	**239**	**272**	*802*

Wildlife: Material & Methods

Laboratory analysis:

- immunofluorescent antibody (IFA) commercial kit (anti- *Cryptosporidium parvum* monoclonal antibody technique)



- Ziehl Neelsen (ZN) – detects all *Cryptosporidium spp.*

- Confirmation of Positives ZN & IFA with RT-PCR

Wildlife: Results

Prevalence with Ziehl-Neelsen staining

	Skukuza	Sabi Sand	Tshokwane	Total/species
Elephant	**34.4%** (12/35)	**35.7%** (10/28)	**6.6%** (2/30)	**25.8%** (24/93)
Buffalo	**3.2%** (1/31)	**6.9%** (2/29)	**6.6%** (2/30)	**5.5%** (5/91)
Impala	**3.2%** (1/31)	**5.9%** (2/34)	**3.5%** (1/29)	**4.2%** (4/94)

Overall prevalence 11.8%

Wildlife: Results

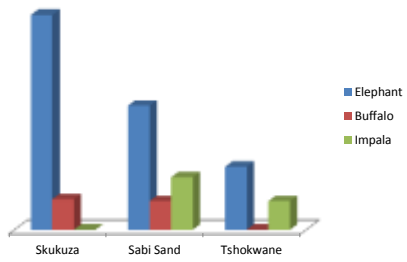
Prevalence with **direct immunofluorescent antibody test** (IFA)

	Skukuza	Sabi Sand	Tshokwane	Total/species
Elephant	**8%** (4/50)	**0%** (0/44)	**4%** (2/50)	**4.2%** (6/144)
Buffalo	**2%** (1/50)	**2.5%** (1/40)	**0%** (0/50)	**1.4%** (2/140)
Impala	**0%** (0/50)	**5%** (3/59)	**0%** (0/50)	**1.8%** (3/161)

Overall prevalence 2.5%

Results wildlife

Variable	Level	OR	95% C.I. (OR)	P-Value
Area	Tshokwane	1*	-	-
	Sabi Sand	3.6	1.2;11.1	0.023
	Skukuza	2.9	1.0; 8.8	0.057
Species	Impla	1*	-	-
	Buffalo	1.3	0.3; 5.2	0.665
	Elephant	8.4	2.8;25.8	< 0.001



Proportion of positive animals by species & area

- Prevalence was significantly higher in elephant than other species.
- Prevalence was higher in areas close to the fence

Wildlife: Main Conclusions

- *Cryptosporidium* spp. are present in KNP wildlife
  - Potential source of infection to livestock & human at the interface?
  - Is wildlife close to the fence more exposed?
- Prevalence might be higher than the one observed
  - Low sensitivity & specificity of ZN
  - Samples may contain genotypes that could not be detected
  - Analyzed samples: collected during dry season


Veterinary Parasitology

Short communication

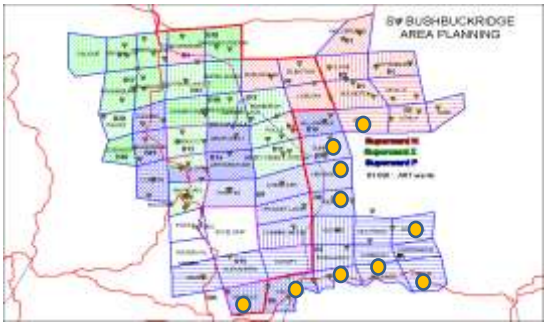
The prevalence of *Cryptosporidium* spp. oocysts in wild mammals in the Kruger National Park, South Africa

Wildlife: Way forward

- Detection of all *Cryptosporidium* spp circulating in the wildlife population: PCR, genotyping & subtyping
- Analysis of seasonal variations (only dry season samples have been analyzed)

Livestock: Study Area

Bushbuckridge: 10 diptanks (●) located in close proximity to the fences of KNP & Sabi Sand



Livestock

- 1000 samples randomly selected
- Collected in rainy and dry season
- All ages
- immunofluorescent antibody (IFA) commercial kit (anti- *Cryptosporidium parvum* monoclonal antibody technique)

Results from dry season

- Overall prevalence: **1% (3/300)**

Livestock: Main Conclusion

Low prevalence in cattle (1%):

- IFA test specific for the detection of *Cryptosporidium parvum* oocysts (species of major zoonotic importance)
- Other *Cryptosporidium* spp. might circulate in cattle

Livestock: Way forward

- PCR, genotyping & subtyping to detect and characterize *Cryptosporidium* strains in the cattle population.

- Analysis of seasonal variations (only dry season samples have been analyzed)

Human communities: Study Area

7 clinics located in communities in close proximity to KNP:

Belfast Clinic
Justicia Clinic
Lillydale Clinic
Lillydale Private Hospital
Agincourt Clinic
Calcutta Clinic
Oakley Clinic

Human communities: Way forward

- Collection of human faecal samples (approx. 200)
- PCR, genotyping & subtyping of human samples to detect the presence of Cryptosporidium and the different Cryptosporidium spp.
- Determine the zoonotic importance of *Cryptosporidium* spp from livestock and wildlife origin.

Expected Results

- Detect different *Cryptosporidium* spp. circulating in the wildlife, livestock & human population
- Establish links between *Cryptosporidium* spp. in humans, livestock & wildlife.
- Comparison of different diagnostic methods

Activities 2011

- **March 2011**: Collection of human faecal samples in the study area (7 clinics in Bushbuckridge).

- **April – August 2011**: PCR, genotyping & subtyping of *Cryptosporidium* of wildlife, cattle & human samples at National Center for Emerging and zoonotic Infectious Diseases, Centers for Disease Control and Prevention (CDC), Atlanta, USA

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Thank You