

Molecular typing reveals important clues on the transmission of *Mycobacterium bovis* to and among free-ranging African wildlife species

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Introduction

◆ *Mycobacterium bovis*

- Obligate pathogen
- Member of the *M. tuberculosis* complex
- Infectious cause of tuberculosis:

<i>M. tuberculosis</i>	→	humans
<i>M. bovis</i>	→	cattle
		> 30 wildlife species
		humans

M. caprae

Dassie bacillus

M. pinnipedii

BTB in KNP (confirmed)

African buffalo

Greater kudu

Lion

Leopard

Cheetah

Honey badger

Warthog

Chacma baboon

Spotted hyena

Large spotted genet

Bushbuck

Impala

BTB



Honey badger,
Genet etc.



Impala,
Bushbuck



Expected benefits of molecular typing (1)

- ◆ Determine whether epidemic was caused by one or more introductions of *M. bovis*



Expected benefits of molecular typing (2)

- ◆ Did *M. bovis* evolve after entering KNP, leading to genetic variations between isolates?
 - Trace recent transmissions within and between animal species
 - Identify other maintenance hosts?
 - Establish whether *M. bovis* “specialises” in particular host species

Materials and methods

- ◆ 156 *M. bovis* isolates characterised from GKNPC and adjacent areas
- ◆ 3 typing tools applied
 - Spoligotyping
 - PGRS RFLP
 - IS6110 RFLP

Materials and methods (2)

Species	No. isolates
Buffalo	101
Lion	27
Kudu	10
Baboon	9
Leopard	3
Cheetah	2
Hyena	3
Warthog	1
Total	156

Results – 1. Spoligotyping

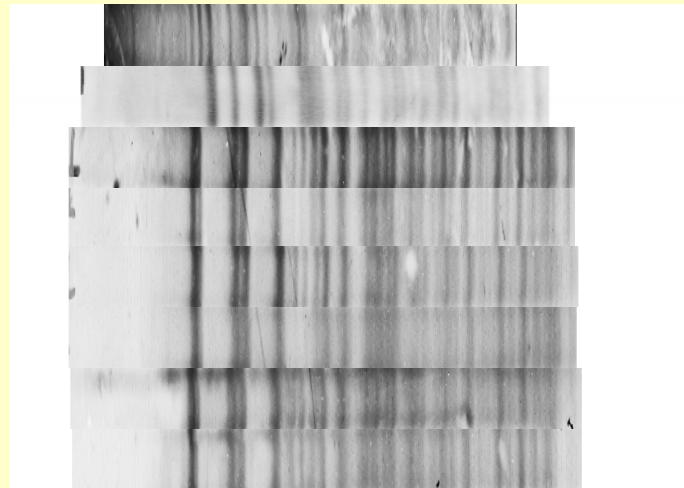
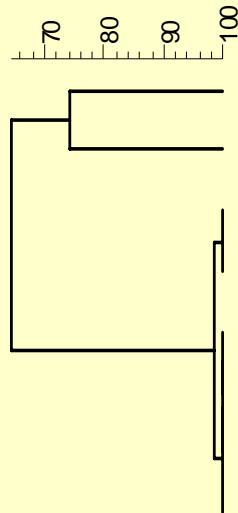


Results – 2. PGRS RFLP

Dice (Cpt1.00%) (Td 0.6%Q9%) (H=00%S=0.0%) [0.0%100.0%]

PGRS

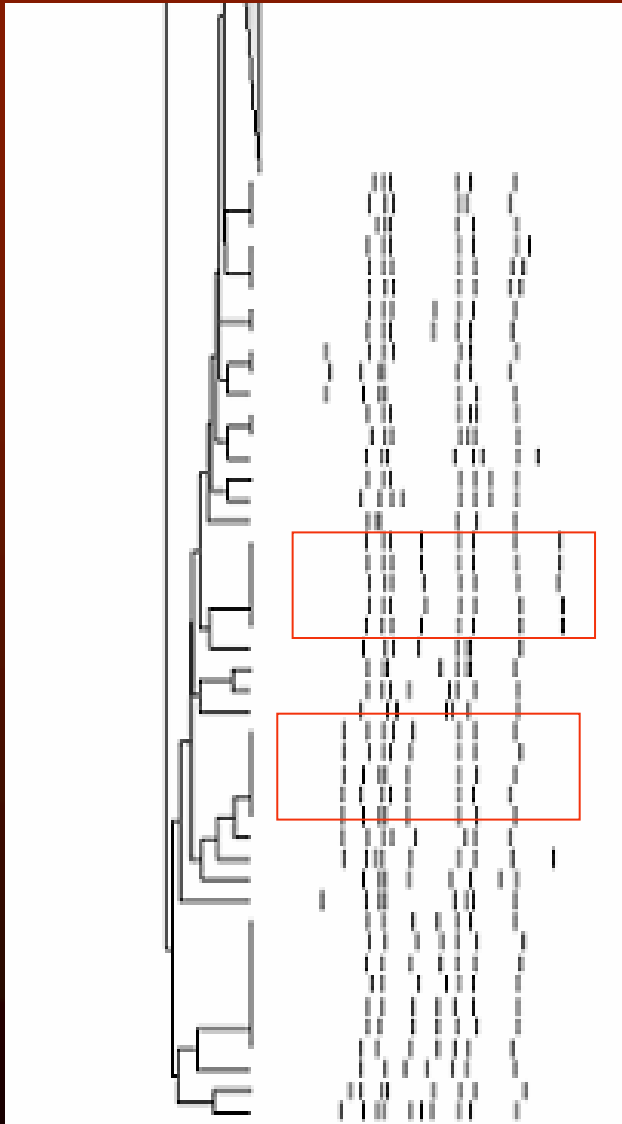
PGRS



TB 1532	BUFFALO
TB 954J	BUFFALO
TB 662	BUFFALO
TB 392	BUFFALO
TB 1088	KUDU
TB 601	BUFFALO
TB 871J.	CATTLE
KNP 147	BUFFALO

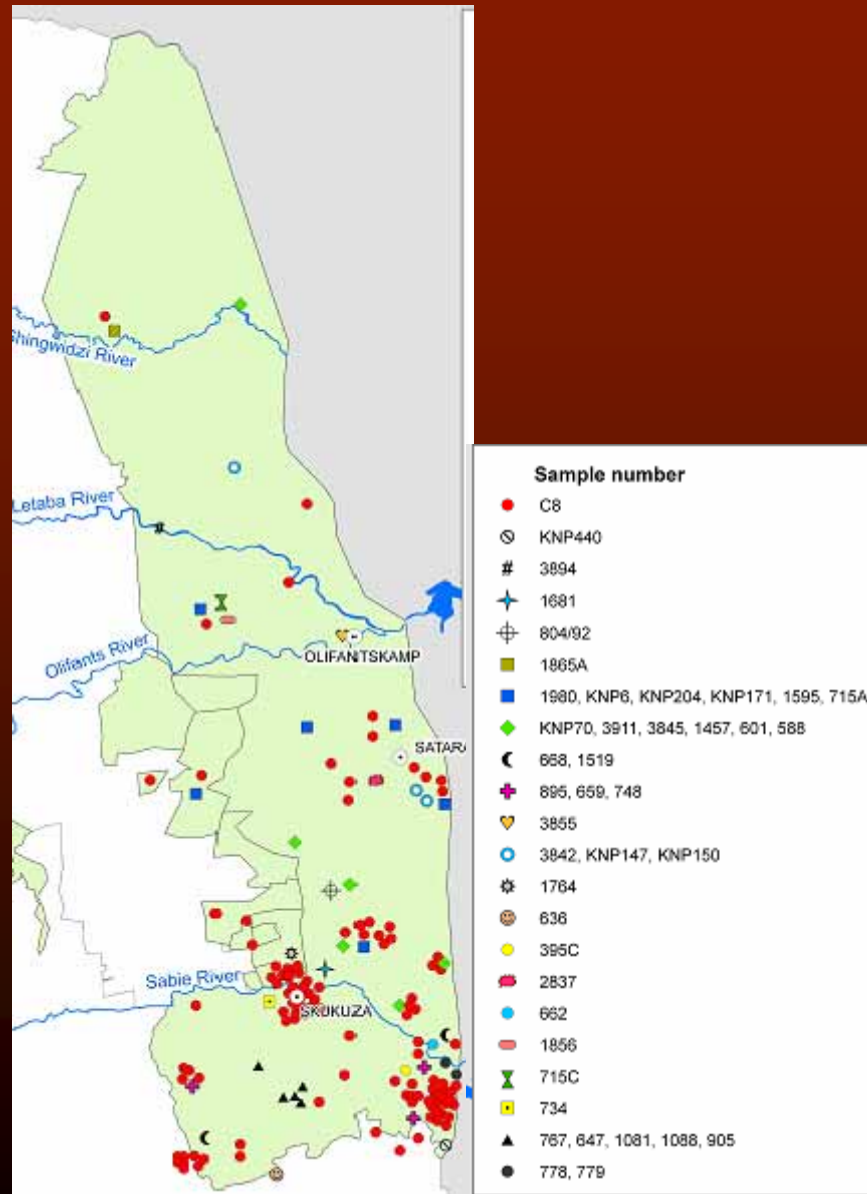
Results –

3. IS6110 RFLP



- ◆ Dominant banding pattern in 135/156 isolates (73%) from multiple species, = C8
- ◆ C8 was found in cattle on neighboring farm in 1993
- ◆ 21 vC8 types found
- ◆ Variant types found in either single or multiple species
- ◆ C8 and a C8v strain were found in the same buffalo
- ◆ vC8 strain unique to a kudu subpopulation

Geographical distribution of *M. bovis* strains



Distribution of C8 & variant strains

	C8	C8v
South	70	18
Central & North	44	24
Total	114	42

Conclusions

- ◆ IS6110 RFLP proved to be the most discriminatory typing tool for KNP isolates
- ◆ Introduction of *M. bovis* into KNP highly likely from cattle on southern border, +/- 1960
- ◆ Epidemic is caused by a single strain which is undergoing genetic changes giving rise to variant strains
- ◆ Evolution of *M. bovis* strains is not accelerated by species cross-over

Conclusions (2)

- ◆ “Kudu cluster”

- Hypothesis: mutation of C8 after introduction into kudu population
- Strain is not species-specific but rather restricted to kudu due to species-specific behaviour which reduces risk of transmission to buffalo

Conclusions (3)

- ◆ Both dominant and variant strains cross species barriers
- ◆ Like in humans, infection with two different *M. bovis* strains appears to be possible in buffalo

Summary

- ◆ Molecular typing using IS6110 RFLP is a useful tool to study the transmission of *M. bovis* in KNP
- ◆ Full value of the typing data will only unfold as the threat of BTB is carried across borders into the GLFTCA





Thank you!



Introduction

Bovine tuberculosis (BTB) in cattle

- ◆ Worldwide distribution
 - Infection or clinical disease recorded since 2005 in 128/155 countries reporting to OIE
- ◆ endemic in cattle in SA, low prevalence
- ◆ Controlled disease because of negative impacts on
 - Livestock farming, trade, human health
- ◆ Eradication or effective control has been achieved in many (developed) countries

The problem:

◆ Internationally

- During eradication BTB has re-emerged in some countries due to previous spillover of *M. bovis* to a wildlife host with maintenance potential

Re-infection of cattle

- Culling of wildlife host
- Study transmission of BTB at cattle/wildlife interface

◆ South Africa

- Wildlife is infected in its own right!

African buffalo

Greater kudu

Lion

Leopard

Cheetah

Honey badger

Warthog

Chacma baboon

Spotted hyena

Large spotted genet

Bushbuck

Impala