

# Barcoding the Flora of the Kruger National Park

Olivier Maurin<sup>(1)</sup>, Renaud Lahaye<sup>(1)</sup>, Sylvie Duthoit<sup>(1)</sup>, Vincent Savolainen<sup>(2)</sup>, Michelle van der Bank<sup>(1)</sup>

(1)University of Johannesburg (South Africa)

(2)Royal Botanic gardens Kew (United Kingdom)



A DNA barcode is a  
short gene sequence  
taken from  
standardized portions  
of the genome,  
used to identify species

# The project

- Large recent plant inventory of the KNP
- Herbarium collection
- DNA bank
- DNA Barcode for every species of the park
- Phylogenetic “tree of life” of the Kruger Park plant genera

# KNP - Plant diversity



*Cadaba termitaria*

*Crinum sp*

*Uvaria gracilipes*

*Combretum padoides*

*Markhamia zanzibarica*

*Grewia sp*

*Gnidia sp*

*Gloriosa superba*

# KNP - Plant diversity

Dicots Herbaceous +/- 1200

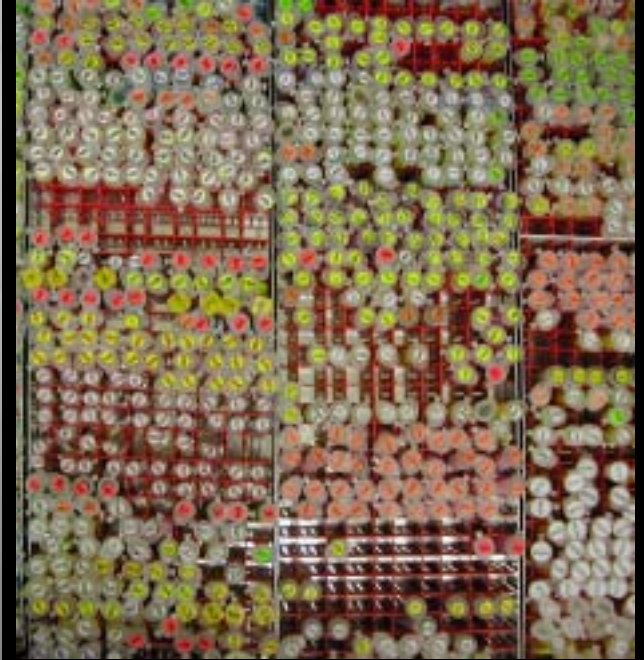
Grasses +/- 200

Bulbs +/- 300

Trees & Shrubs +/- 400



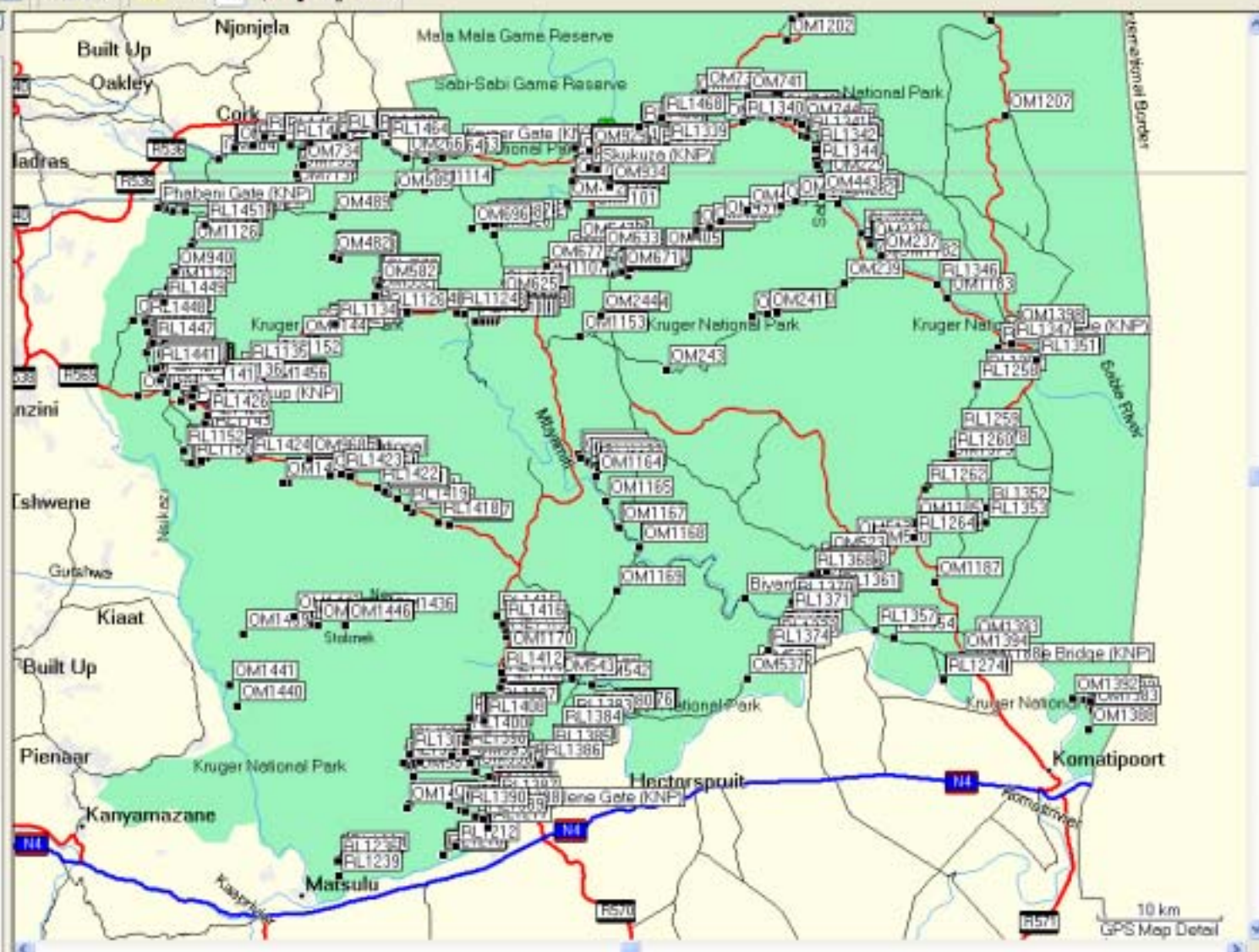
# Herbarium / Silica / Spirit / DNA



Show waypoints in category:

All Categories

Name	Symbol	Comment	Pa
OM1123	•		S2E
OM1124	•		S2E
OM1125	•		S2E
OM1126	•		S2E
OM1128	•		S2E
OM1129	•		S2E
OM1130	•		S2E
OM1131	•		S2E
OM1132	•		S2E
OM1133	•		S2E
OM1134	•		S2E
OM1136	•		S2E
OM1138	•		S2E
OM1139	•		S2E
OM1140	•		S2E
OM1141	•		S2E
OM1142	•		S2E
OM1144	•		S2E
OM1145	•		S2E
OM1146	•		S2E
OM1148	•		S2E
OM1149	•		S2E
OM1152	•		S2E
OM1153	•		S2E
OM1154	•		S2E
OM1155	•		S2E
OM1156	•		S2E
OM1157	•		S2E
OM1159	•		S2E
OM1160	•		S2E
OM1162	•		S2E
OM1163	•		S2E
OM1164	•		S2E
OM1165	•		S2E
OM1166	•		S2E
OM1167	•		S2E



# Data management

## DNA Barcoding the Flora of the Kruger national Park

### Specimen Identifiers

Sample ID:	02-SRNP-16276	Museum ID:	02-SRNP-16276
Isolate / Field Num:		Collection Code:	
Donated By:		Deposited In:	Smithsonian Institution

### Taxonomy

Identifier:	18
phylum:	Arthropoda
class:	Insecta
order:	Lepidoptera
family:	Hesperiidae
subfamily:	Pyginae
genus:	Anasthus
species:	Anasthus obscurus

### Specimen Details

Voucher Type:	
Tissue Type:	
Extra Info:	Pyginae
Sex:	m
Reproduction:	s
Life Stage:	

### Collection Data

Collectors:	Roster Moraga
Date Collected:	12-Jul-2002
Country:	Costa Rica
State/Province:	Guanacaste
Region/Country:	Area de Conservacion 276
Sector:	Del Oro
Exact Site:	Uncana
Latitude:	11.0291
Longitude:	-85.4792
Coord. Source:	
Elevation/Depth:	300



### Photographs



## DNA Barcoding the Flora of the Kruger national Park

## DNA Barcoding the Flora of the Kruger national Park

*Hesperiidae of the ACG 1 [CSCR]*

### Specimen Identifiers

Sample ID:	02-SRNP-16276	Catalog Number:	02-SRNP-16276
Isolate / Field Num:		Collection Code:	
Donated By:			



## DNA Barcoding the Flora of the Kruger national Park

### Photographs

Dorsal View



### Specimen Identifiers

Sample ID:	02-SRNP-16276	Catalog Number:	02-SRNP-16276
Isolate / Field Num:		Collection Code:	
Donated By:		Vouchered at:	2

### Photographs

Dorsal View



# Networking the data

**South African NATIONAL PARKS**

**UNIVERSITY OF LIMPOPO**

## DNA Barcoding the Flora of the Kruger national Park

**Specimens Information**

Sample ID:	SI-07NP-14276	Museum ID:	SI-07NP-14276
Collector (Field Name):		Collection Code:	
Occurrence:		Expository:	Unifunctional Institution

**Taxonomy**

Kingdom:	Euk
phylum:	Archaeplastida
class:	Tracheophytes
order:	Lycopodiales
Family:	Polypodiaceae
subfamily:	Polypodiinae
genus:	Asplenium
species:	Asplenium nidus

**Specimen Details**

Voucher Type:	
Threat Type:	
Link a file:	Polypodiaceae
Sex:	m
Reproduction:	s
Life Stage:	

**Collection Data**

Collector:	W. J. S. & M. J. S.
Date Collected:	12-Jul-2002
Country:	South Africa
State Province:	North West
Region County:	Area 10
Locality:	CR1000/001 276
Number:	041 014
Exact Site:	Unesco
Latitude:	11.8200
Longitude:	49.4100
Coordinate System:	WGS84

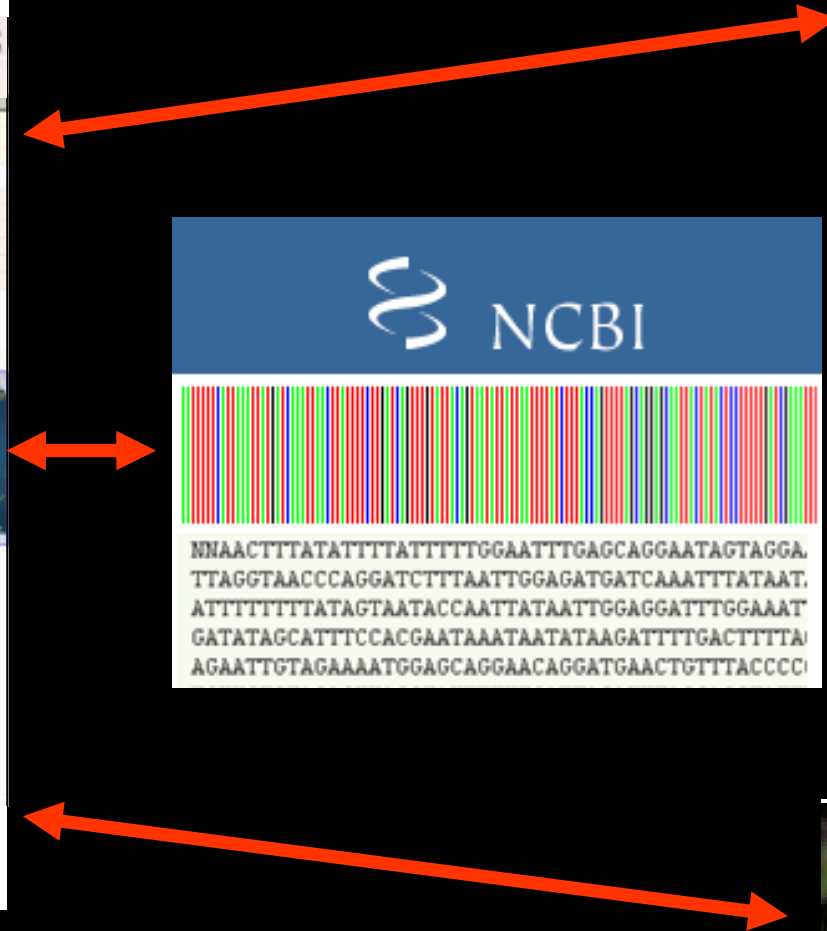
**Photographs**

**GBIF** Global Biodiversity Information Facility

**NCBI**

NNAACTTTATATTTTATTTTTGGAAATTTGAGCAGGAATAGTAGGA.  
TTAGGTAACCCAGGATCTTTAATTGGAGATGATCAAATTTATAAT.  
ATTTTTTTTATAGTAATACCAATTATAATTGGAGGATTTGGAAAT  
GATATAGCATTTCACGAATAAATAATAAGATTTTGACTTTTA/  
AGAATTGTAGAAAAATGGAGCAGGAACAGGATGAACTGTTTACCCC!

**IUCN**  
The World Conservation Union





# DNA BARCODING THE KNP FLORA...

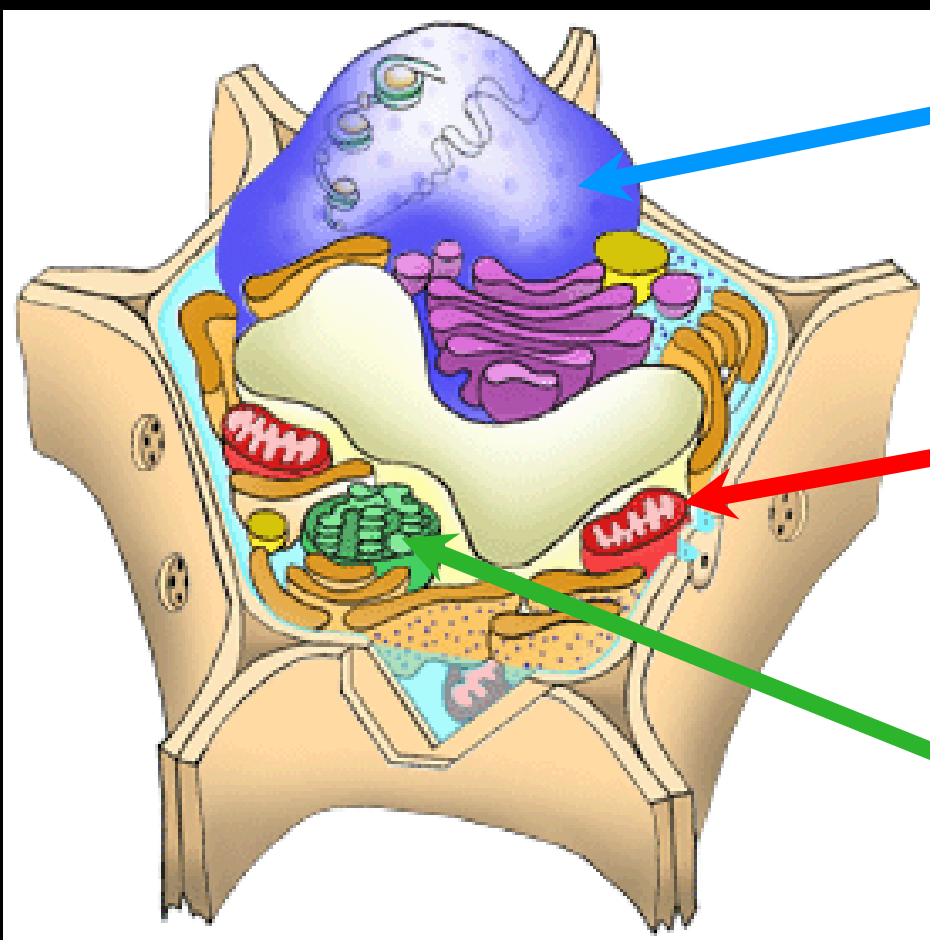


**FOR PLANTS: NO DNA barcode identified yet...**

Nuclear DNA: hybrids,  
recombination...

Mitochondrial DNA: not  
enough variability to  
discriminate species...

**Solution: Chloroplast  
DNA, maternally  
inherited and potentially  
variable enough...**



# Animal Diet



Species A

Species B

Species C

Species D

Species E...

# Ecological Survey...

Plot to sample



Species A

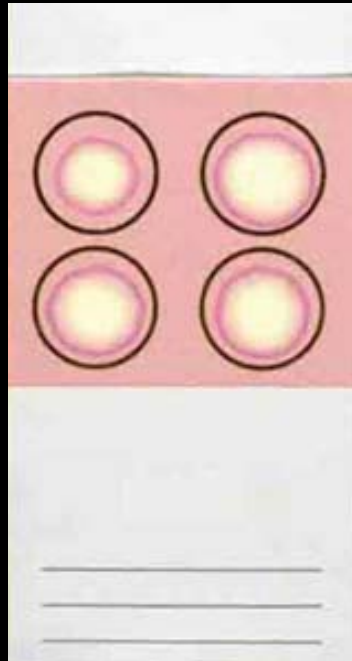
Species B

Species C

Species D

Species E...

# Whatman DNA Storage Paper Systems



# DNA BARCODING THE KNP FLORA...



<b>After 1 year...</b>	Representatives collected	Relative % collected according to van der Schijff checklist (1969)
Families	<b>113</b>	<b>85%</b>
Genera	<b>360</b>	<b>52%</b>
identified species	<b>431</b>	<b>25%</b>

# DNA BARCODING THE KNP FLORA...

## TESTING POTENTIAL DNA BARCODE ON A REDUCED SAMPLING

\*Plant Working Group: 5  
regions advised  
(6 from updated protocols)

\* Newmaster et al., 2006

\* Kress et al., 2005

Potential DNA Barcode	Reference
matK	Plant DNA Working Group
rpoC 1	Plant DNA Working Group
rpoB	Plant DNA Working Group
accD	Plant DNA Working Group
YCF5	Plant DNA Working Group
rbcL	Newmaster et al., 2006
trnHpsbA	Kress et al., 2005

**Potential DNA  
Barcode**

**% of species  
correctly identified**

**matK**

**95%**

**ycf5**

**57%**

**Ycf5 + rbcL + rpoB**

**92%**

**rpoc1**

**28%**

# science in Kruger

## A barcode for every plant in Kruger?

By Melissa Wray  
In Kruger National Park

Science fiction is rapidly meeting science fact in the world of genetic research, and a team of scientists working in the Kruger National Park (KNP) are taking early steps in a process that will someday allow a person to take the tiniest scrap of a plant's leaf, drop it into a handheld machine and see

...sider that there are some 300,000 different plant species on earth. Kruger is playing an important role in this race and is already a fore-runner in that over the last several months more than 1,600 different specimens (around 600 different species) of plants in the park have donated a few leaves to science. This represents the largest and most diverse sampling ever made for DNA barcoding purposes in a

way to act as herbarium specimens, in much the same way as early explorers collected the plant life outside of their home countries. The second specimens that the barcoding team collects are fresh leaves, which are placed in a special silica gel which rapidly dries them out without harming the all-important DNA inside.

The samples are then taken back

Below: Renaud Lahaye in the molecular laboratory where the DNA



### Scientists barcode SA flora

A small group of scientists led by the UJ's Dr Michelle van der Bank has launched an ambitious project to collect all the plants of the Kruger National Park and use DNA sequencing and barcoding techniques to study this rich flora of South Africa.

DNA sequencing is becoming a popular tool to study organisms. In plants, it is used to study relationships and to track down the history of species diversification or drawing the "genealogic trees" of groups of organisms.

In 2004, the Consortium of Barcode of Life launched an initiative to promote DNA barcoding, a process enabling the rapid and inexpensive identification of the estimated 10 million species on earth.

The technique has been successfully applied to animals. However, in the case of plants, the search for short fragments of DNA that will act as "barcode" has not been successful. Now scientists from 11 institutions all over the world are searching for the elusive gene that will allow them to barcode all 300 000 species of plants on earth.

As part of this effort, Dr Van der Bank and her team – Vincent Savolainen of the Royal Botanic Gardens in Kew, UK, and three UJ postgraduate students, Olivier Maurin, Renaud Lahaye and Sylvie du Thoit – started collecting plants in Kruger in September 2005. To date, they have collected more than 1 600 specimens of plants. This initiative represents the most complete and recent inventory of the park's rich flora. It is also the largest and most diverse sampling ever made for barcoding purposes in a protected area.

All samples are taken back to the UJ where they are analysed, categorised and stored. DNA duplicates are then sent off to Kruger and other institutions such as Kirstenbosch Botanical Gardens. Plants are also under way to have their data placed on the Consortium of Barcoding's website where they will be available for other scientists.



### Mail & Guardian online

#### SA scientists hunt for elusive plant 'barcode'

Johannesburg, South Africa

21 November 2006 03:29

A University of Johannesburg project hopes to track down the elusive genetic barcode of Earth's plant species through research at the Kruger National Park, the university said on Tuesday.

A small team of scientists aims to collect examples of all the plants in the park and has collected 1 600 specimens so far, said university spokesperson Herman Esterhuizen.

The plants will be studied using DNA sequencing and barcoding techniques.

DNA barcoding allows quick and inexpensive species identification. It has been successfully applied to animals but not yet to plants, he said.

"We hope to be the team to identify the genetic barcode for plants," said team leader Dr Michelle van der Bank, of the department of botany and biotechnology.

This would allow botanists to do groundbreaking identification of species using the barcoding method, she said.

"People around the world are working to find out which part of the genome will be used to identify any plant because that hasn't been found yet," said team member Olivier Maurin.

Collecting samples at the Kruger National Park offers the best way to try to find the barcode, he said.

The collection process started in September last year and is the most complete and recent inventory of the park's flora. Samples are analysed, categorised and stored at the university, and DNA duplicates are sent to the park and other institutions.

In 2004 an international initiative was launched to promote DNA barcoding.

"In the case of plants, the search for short fragments of DNA that will act as 'barcode' has thus far proved unsuccessful," said Esterhuizen.

Scientists from 11 institutions are searching for the "elusive gene" that would allow them to barcode the Earth's 300 000 plant species, he said. – Sapa

### The Star WEDNESDAY NOVEMBER 22 2006

## Scientists will scan Kruger Park flora in quest for genetic secrets

A University of Johannesburg project hopes to track down the elusive genetic barcode of Earth's plant species through research.

University spokesperson Herman Esterhuizen yesterday said a small team of scientists aimed to collect all the plants in the Kruger National Park and had collected 1600 specimens so far.

The plants will be studied using DNA sequencing and barcoding techniques.

DNA barcoding allowed quick and inexpensive species identification and had been successfully applied to animals but not yet to plants, Esterhuizen said.

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...vision of Bank from nesburg and from the Royal Botanic Gardens at Kew in London. The project has been conducted in conjunction with the inventory

Olivier Maurin, Sylvie du Thoit and Renaud Lahaye will collect samples of plants in the park and store them in a pre-determined programme. The specimens will be analysed using DNA sequencing systems with the aim of identifying the elusive gene that will allow them to barcode the Earth's 300 000 plant species, he said.

# Acknowledgments

- Financial supports: SASOL, NRF, UJ
- Honours Students
- SANPARKS (KNP Scientific Services, Veterinary Services, Field scientific assistants, section rangers)
- CBOL, Plant working group, worldwide scientific community...