The National Collection of Fungi: A database for phytopathogenic and soilborne fungi from South Africa

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Background

The Mycology Unit of the Biosystematics Division, ARC-Plant Protection Research, serves as the custodian of South Africa’s National Collections of Fungi (SANCF). The Collections consist of two major collections, as well as several smaller collections. The live culture collection (PPRI) houses 22000 specimens at present and is affiliated with the World Federation of Culture Collections. The herbarium collection (PREM) traces its origin back 111 years and currently accommodates more than 61000 specimens, including ca. 3000 type specimens. These specimens represent not only South African, but African fungal diversity as well. Results: DNA barcodes have been generated for 2537 fungal strains in the PPRI collection. These represent 93 genera and 150 species. Different gene regions were selected depending on the most appropriate gene regions identified for the specific genera. The original genus identifications were based on morphological identifications. Significance: The mobilization of collection data associated with PREM specimen holdings and literature, as well as the generation of DNA barcodes for all species represented in the PPRI collection, will facilitate the establishment of a portal for South African phytopathogenic and soilborne fungi. These data portals will facilitate accurate identifications by quarantine officials, scientists and citizen scientists.

Introduction

The South African National Collections of Fungi (SANCF), established in 1905, houses predominantly dried fungal reference material and living fungal cultures from African countries. There is also representation from the other five continents in the 63 000 rich specimen holdings in the herbarium collection (acronym PREM) and 23 000 living cultures in the World Federation of Culture Collections affiliated culture collection. Research collections of well-known South African scientists such as Ethel Dodge, Edith Stephens, Van der Bijl, and Wally Marasas were also incorporated over the past 112 years. The SANCF contains numerous plant pathogens that are of agricultural and/or plant quarantine importance, and beneficial saprobic fungi. The PREM collection is the largest and the most definitive collection on the African continent and houses more than 2300 type specimens.

Did you know?

The first record of macro fungi collected in South Africa was in 1772. The first publication on South African fungal biodiversity dates back to 1843. The abbreviation PREM stands for PREMoria and Mycology. The SA National Collections of Fungi, PREM collection is 112 years old. 2 300 of these specimens represent the type material. The South African National Department of Agriculture, Fisheries and Forestry base their pathogen status enquiries on the material in the collection. Literature housed as part of the SANCF dates from 1755 to the present. Some of these represent the only remaining copy of the published work.

In general the material deposited in all reference collections:

• Reflects the biodiversity of the region that they represent.
• Ensures verification (repeatability) for research purposes.
• Serves as a record of geographical distribution and host range (Baird, 2010; Biodiversity Informatics: 7, 130 – 136.).

Besides the abovementioned reasons, material deposited in the SANCF also contributes to the fulfillment South Africa’s obligations as part of the following International agreements:

a) Convention on biodiversity (http://www.cbd.int/).

At the 1992 Earth Summit in Rio de Janeiro, world leaders agreed on a comprehensive strategy for "sustainable development – meeting our needs while ensuring that we have a healthy and viable world for future generations". One of the key agreements adopted at this summit was the Convention on Biological Diversity. South Africa became a signatory in 1995. Depositing material in the SANCF supports three of the national strategic objectives set by the South African government.

b) Nagoya protocol (www.cbd.int/abs)

South Africa became a signatory of this protocol in 2000 and depositing material in the SANCF supports objectives in four different articles of the agreement. These include:

Article 5: Fair and equitable benefit-sharing.

In accordance with Article 15, paragraphs 3 and 7 of the Convention, benefits arising from the utilization of genetic resources as well as subsequent applications and commercialization shall be shared in a fair and equitable way with the Party providing such resources that is the country of origin of such resources or a Party that has acquired the genetic resources in accordance with the Convention.

Current collaborations:

The mobilization of collection data and literature associated with PREM specimen holdings, as well as the generation of DNA barcodes for all species represented in the PPRI collection, will facilitate the establishment of a portal for South African phytopathogenic and soilborne fungi. These data portals will facilitate accurate identifications by quarantine officials, scientists and citizen scientists.

Article 6: Access to genetic resources

In the exercise of sovereign rights over natural resources, and subject to domestic access and benefit sharing legislation or regulatory requirements, access to genetic resources for their utilization shall be subject to the prior informed consent of the Party providing such resources that is the country of origin of such resources or a Party that has acquired the genetic resources in accordance with the Convention, unless otherwise determined by that Party.

Article 7: Contribution to conservation and sustainable use

The Parties shall encourage users and providers to direct benefits arising from the utilization of genetic resources towards the conservation of biological diversity and the sustainable use of its components.

Article 11: Trans-boundary cooperation

In instances where the same genetic resources are found in situ within the territory of more than one Party, these Parties shall endeavor to cooperate, as appropriate, with the involvement of indigenous and local communities concerned, where applicable, with a view to implementing this Protocol.

c) National Environmental management: Biodiversity Act (Act 10 of 2004): Chapter 3: Involving bioregions and bioregional plans to provide for integrated and coordinated biodiversity planning; to provide for monitoring of the conservation status of various components of South Africa’s biodiversity; and to promote biodiversity research.

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Fig 1: Genres for which DNA barcodes have been generated

- 10% of strains, mostly of quarantine importance have been completed to date. The internal transcribed spacer (ITS) gene region has been accepted as the DNA barcode for fungi (Scholler et al., 2012; PNAS: 109 6241–6246), and will be generated for the majority of the fungal strains deposited. In the case of fungal genera where this gene region is inadequate to demarcate species other gene regions such as the translation elongation factor 1-alpha (EF-1a) and RNA polymerase II second largest subunit (RPB2) genes will form the basis of identification.
- First information regarding the fungal kingdom of South Africa, was contributed to the GBIF node in South Africa, SABIF.

Conclusion:

DNA barcoding and the digitization of metadata associated with specimen holdings in the National Collections of Fungi will enable the research community, quarantine officers and other government agencies to access important information effectively. The DNA barcodes will further assist in the accurate and timely identification of South African phytopathogenic and soilborne fungi.