CASE STUDY:
CAB Abstracts on CAB Direct
Panama disease of bananas

CAB Abstracts is the most complete applied life sciences literature database in the world. Its coverage includes agriculture, environment, veterinary sciences, applied economics, food science and nutrition.

CABI’s online database platform, CAB Direct, has been built specifically for researchers working in the applied life sciences to help them use CAB Abstracts to research complex problems quickly and with precision.
Panama disease of bananas

In the 1950s, Panama disease virtually destroyed the banana crop worldwide. Plantations were replanted with Cavendish bananas which were resistant to the disease. A new strain of Panama disease, Tropical Race 4 or TR4, has emerged which Cavendish bananas are susceptible to. TR4 is destroying banana plantations in Southeast Asia and has spread to Northern Australia, the Middle East and Africa.

No single method of controlling TR4 has been identified and the global supply of bananas is once again under threat.

**CAB Abstracts** is the most comprehensive database of applied life sciences literature in the world. CAB Direct is the only online platform built specifically to help researchers maximise the potential of CAB Abstracts.

On **CAB Direct**, CAB Abstracts can help researchers understand the scale of the problem and identify potential methods or combinations of methods for managing Panama disease, particularly strain TR4.

The screenshots in this case study show **CAB Abstracts in use on the CAB Direct platform**.
CAB Abstracts contains over 8.4 million records providing access to the world’s applied life sciences literature.
Searching CAB Abstracts for the phrase “Panama disease” gives us some results, and the information you require to develop the search.

On CAB Direct, the results page has been designed to make searching for relevance fast and simple.


   In the irrigated area of Jaíba in Northern Minas Gerais, there are reports on the presence of some genotypes of banana cv. Prata-Anã supposedly tolerant to the Panama disease, where the disease was not established after 15 years of cultivation even in the presence of the pathogen. Therefore this...

   **Foreign Title**: Diversidade genética, crescimento e produção de genótipos de bananeira ‘Prata-Anã’ em área com mal do Panamá.

   **Author(s)**: Lopes, O. P.; Mala, V. M.; Xavier, A. A.; Costa, M. R. da; Rodrigues, M. G. Y.

   **Publisher**: Sociedade Brasileira de Fruticultura, Jaboticabal, Brazil

   **Journal article**: Revista Brasileira de Fruticultura 2014 Vol.36 No.4 pp.924-939 ref.29

2. Tropical race 4 of Panama disease in the Middle East.

   Panama disease (aka Fusarium wilt) of banana (Musa spp.) has been a destructive problem for well over a century. Race 1 of the pathogen, *Fusarium oxysporum* f. sp. *cubense* (Fo), was responsible for the demise of the first export trades of banana that were based on the cultivar ‘Gros Michel’....

   **Author(s)**: Biloet, R.; Freeman, S.; Konkol, I.; Al-Abed, A.; Naser, Z.; Shalan, K.; Barakat, R.; Israeli, Y.

   **Publisher**: Springer, Dordrecht, Netherlands

   **Journal article**: *Phytoparasitica* 2015 Vol.43 No.3 pp.283-293 ref.51

3. Evaluation of different banana genotypes for resistance to Panama disease.

   Panama disease, or fusarium wilt disease, caused by the fungus *Fusarium oxysporum* f.sp. *cubense* is a disease causing great losses in banana production worldwide, hindering production in certain areas of the world. In Brazil, banana crop has suffered great losses due to favorable soil and climate...

   **Author(s)**: Garcez, M.; Martins, I. A. S.; Rodrigues, E. I. R.

   **Publisher**: Universidade Federal de Uberlândia, Uberlândia, Brazil

   **Journal article**: *Bioscience Journal* 2016 Vol.32 No.2 pp.431-435 ref.10


   Intercropping and rotating banana (Musa spp.) with Chinese chive (*Allium tuberosum* Rottler) has been used as an effective method to control Panama disease (Fusarium wilt) of banana in
To make searching really powerful, CAB Abstracts is indexed using the CAB Thesaurus, the largest and most comprehensive controlled vocabulary in the applied life sciences.

CAB Direct uses a new visual interface so we can quickly see which terms are most commonly used, and easily identify and refine by the correct organism descriptions for Panama disease.
Now that we have a search strategy developing and a set of results to work with, we can use the ‘My Projects’ feature on CAB Direct to save and organise our searches and results.

It’s quick and simple to sign-up for a ‘My CABI’ account and with this we can save searches and records, create and work on projects, highlight records and add annotations as well.
We can now go back to the search results, develop the search strategy and save searches to the project.
The Edit Search function is an easy way to remove the informal search phrase “Panama disease”, so that we use only the correct organism names. This gives us many more results to work with.
We can use the interactive date chart to restrict the results to recently published articles, in this case articles published in 2015.

And we can select interesting records and save them to the project too.
In CAB Abstracts on CAB Direct, we can highlight significant passages of text.

Here we see that CAB Abstracts covers research that examines the scale of the problem, its potential economic impact and methods for detecting it.


**Author(s)**: Ploetz, R. C.
**Author Affiliation**: University of Florida, 18905 SW 280th Street, Homestead, FL 33031-3514, USA.
**Author Email**: kelly12@ufl.edu
**Editors**: Elmer, W.
**Journal article**: Crop Protection 2015 Vol.73 pp.7-15 ref:many
**ISSN**: 0261-2194
**DOI**: 10.1016/j.cropro.2015.01.007
**URL**: http://www.sciencedirect.com/science/
**Record Number**: 20153216710

**Abstract**:
Banana (*Musa* spp.) is an important cash and food crop in the tropics and subtropics. Fusarium wilt, which is also known as Panama disease, is caused by *Fusarium oxysporum* f. sp. *cubense* (Foc). It is one of the most destructive diseases of this crop, and has a relatively wide host range. Its greatest impact was on the early ‘Gros Michel’-based export trades. Resistant cultivars of the Cavendish subgroup were used to replace ‘Gros Michel’, but are now succumbing to a new variant of the pathogen, tropical race 4 (TR4). Although TR4 is only found in the Eastern Hemisphere, it threatens global export and small-holder production of the Cavendish cultivars. Management of this disease is largely restricted to excluding the pathogen from non-infested areas and the use of resistant cultivars where Foc is established. The perennial production of this crop and the polycyclic nature of this disease hinder the development of other management strategies. Measures that are effective against annual or short-lived hosts of these diseases are usually ineffective against Fusarium wilt of banana. Effective biological, chemical and cultural measures are not available, despite a substantial, positive literature on these topics. Critical evaluations of, and realistic expectations for, these measures are needed. Better resistance is needed to this disease, especially that is caused by TR4.

**Publisher**: Elsevier Ltd
In CAB Direct we can organise our data by using different colours to highlight different parts of the abstract, for example the research objective and the results.

**Potential economic impact of Panama disease (tropical race 4) on the Australian banana industry.**

**Author(s):** Cook, D. C.; Taylor, A. S.; Meldrum, R. A.; Drenth, A.

**Author Affiliation:** Department of Agriculture and Food Western Australia, Bunbury WA 6231, Australia.

**Author Email:** david.cook@agric.wa.gov.au

**Journal article:** Journal of Plant Diseases and Protection 2015 Vol.122 No.5/6 pp.229-237 ref.29

**ISSN:** 1861-3829

**URL:** http://www.ipip-online.com

**Record Number:** 2016017915

**Abstract:**
Panama disease, caused by *Fusarium oxysporum* f.sp. cubense tropical race 4, is considered to be one of the most severe threats facing the banana industry worldwide. Tropical race 4 has rapidly spread throughout Southeast Asia since first being reported from Taiwan in 1990 and Indonesia in 1992. It was first discovered in Australia in 1997 where strict quarantine management contained its distribution to the Northern Territory for almost two decades until March 2015 when it was detected in Tully, North Queensland. The spread of this disease to the major banana production areas in Queensland could have a severe impact on the Australian banana industry as no effective chemical control options exist and no resistance has as yet been identified in agronomically acceptable banana varieties. However, given its successful containment in the Northern Territory there is uncertainty about future losses, and consequently what resources should be expended on its continued control. In this paper, we construct a dynamic model to estimate potential financial consequences for the Australia banana industry over time if the disease spreads beyond its current distribution. Scenarios modelled account for the possibility of spread via natural means described by a diffusion-like process, and also by large jumps mediated by human activities. **Aggregating results of likely spread over time, we predict the disease will cause industry losses exceeding $138 million per year despite a slow rate of spread.**

**Publisher:** Eugen Ulmer KG

**Location of publication:** Stuttgart
The abstract below describes a sensitive, specific and rapid detection method (real time PCR) for determining infection – the first step for preventing disease spread and implementing control measures.

With CAB Direct we can create our own notes, by annotating records, to add context and meaning.
With CAB Abstracts on CAB Direct, you can easily extend your query.

Using the Topics function, research into control methods can be found in CAB Abstracts.
The results show that an endophyte is one of the methods of control in the research literature.
Results include an article suggesting that the endophytes have shown positive results.

**In planta** biocontrol of soilborne *Fusarium* wilt of banana through a plant endophytic bacterium, *Burkholderia cenocepacia* 869T2.

**Author(s):** Hio Ying Ting; Chiang Hoing Mei; Chao Chin Ping; Su Ching Chung; Hsu Hui Fang; Guo Chen Tong; Hsieh Jui Lian; Huang Chieh Chen

**Author Affiliation:** Department of Life Sciences, College of Life Sciences, National Chung Hsing University, 250, Kuo Kuang Rd, Taichung, 402, Taiwan.

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**Journal Article:** Plant and Soil 2015 Vol.387 No.1/2 pp:295-306 ref:42

**ISSN:** 0032-0435

**URL:** [http://rd.springer.com/journal/11104](http://rd.springer.com/journal/11104)

**Record Number:** 2015J066874

**Abstract:**

**Aim:** *Fusarium* wilt (Panama disease) caused by *Fusarium oxysporum* f. sp. *cubense* tropical race 4 (Foc TR4) is a soilborne disease that severely devastates the banana industry worldwide. We aimed to isolate beneficial endophytic bacterial strains against Panama disease. **Methods:** From different plant species, including reeds (*Phragmites australis*), vetiver grass (*Chrysopogon zizanioides*), and banana plants (*Cavendish cv. Pei-Chiao*, *Cavendish cv. Formsanosa*, and *Musa sapientum cv. Rose*), endophytes were screened and characterized. The diversity and community of endophytes within banana plants were analyzed by PCR-denaturing gradient gel electrophoresis (DGGE). The banana tissue culture plantlets were inoculated with the candidate endophyte, *Burkholderia cenocepacia* 869T2, and effects of *in planta* biocontrol were observed. **Results:** Endophytic *B. cenocepacia* 869T2 decreased the disease incidence of *Fusarium* wilt on treated banana plants to 3.4%, comparing to 24.5% of non-inoculated plants infected in the field test within a 7-month period. Furthermore, significant growth promoting of 869T2 inoculated banana plants was observed in field experiments. **Conclusions:** In addition to 869T2 genomic sequence data, our results suggest that the pyrrolintri and pyrroloquinoline quinone potential producer, *B. cenocepacia* 869T2, is a good biological control agent (BCA) for use in the biocontrol of *Fusarium* wilt and plant promotion.
We can use CAB Direct to create a new search based on the index terms from the previous record.

By simply adding an additional keyword (via Edit Search), CAB Abstracts can be used to look for other relevant research into endophytes that could provide additional insights, in this case, mycotoxins.
We find evidence that mycotoxin accumulation can be inhibited when used against a different Fusarium species.

Bacterial endophytes from wild maize suppress *Fusarium graminearum* in modern maize and inhibit mycotoxin accumulation.

**Abstract:**
Wild maize (teosinte) has been reported to be less susceptible to pests than their modern maize (corn) relatives. Endophytes, defined as microbes that inhabit plants without causing disease, are known for their ability to antagonize plant pests and pathogens. We hypothesized that the wild relatives of modern maize may host endophytes that combat pathogens. *Fusarium graminearum* is the fungus that causes Gibberella Ear Rot (GER) in modern maize and produces the mycotoxin, deoxynivalenol (DON). In this study, 215 bacterial endophytes, previously isolated from diverse maize genotypes including wild teosinte, traditional landraces and modern varieties, were tested for their ability to antagonize *F. graminearum in vitro*. Candidate endophytes were then tested for their ability to suppress GER in modern maize in independent greenhouse trials. The results revealed that three candidate endophytes derived from wild teosintes were most potent in suppressing *F. graminearum in vitro* and GER in a modern maize hybrid. These wild teosinte endophytes could suppress a broad spectrum of fungal pathogens of modern crops in vitro. The teosinte endophytes also suppressed DON mycotoxin during storage to below acceptable safety threshold levels. A fourth, less robust anti-fungal strain was isolated from a modern maize hybrid. Three of the anti-fungal endophytes were predicted to be *Paenibacillus polymyxa*, along with one strain of *Citrobacter*. Microscopy studies suggested a fungicidal mode of action by all four strains. Molecular and biochemical studies showed that the *P. polymyxa* strains produced the previously characterized anti-*Fusarium* compound, fusaricidin. Our results suggest that the wild relatives of modern crops may serve as a valuable reservoir for endophytes in the ongoing fight against serious threats to modern agriculture. We discuss the possible impact of crop evolution and domestication on endophytes in the context of plant defense.
However, the research shows that there may be potential risks, and CAB Abstracts covers research that examines the risks of introducing invasive endophytes too.
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