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Fusarium musae, a potential new food safety threat. Can a diseased banana be the source of a fungal disease for humans?

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This PhD thesis research project is aimed at giving a comprehensive analysis of a cross-kingdom pathogen such as *Fusarium musae*. The final goal is to combine studies within different disciplinary fields to have a better understanding on the mechanism of infection and the ability to be transmitted from banana to humans, but also on the diversity of the species and physiological characteristics of strains with different origin. In this way we hope to build a reference model that could be used also for the investigation of other fungal cross-kingdom pathogens.

***Fusarium musae*, una nuova potenziale minaccia per la sicurezza alimentare. Può una banana malata essere fonte di malattia fungina per l'uomo?**

Questo progetto di tesi di dottorato mira a dare un'analisi completa di un cross-kingdom pathogen come *Fusarium musae*. Lo scopo finale è quello di combinare conoscenze in campi diversi in modo da avere una visione più completa possibile sui meccanismi di infezione e la capacità di essere trasmesso da banana a uomo, ma anche sulla diversità della specie e sulle caratteristiche fisiologiche di ceppi con diversa origine. In questo modo speriamo di fissare un modello che possa essere utilizzato anche durante lo studio di altri cross-kingdom pathogens.

Key words: Cross-kingdom pathogen, *Fusarium musae*, in vivo imaging, genomics, transcriptomics.

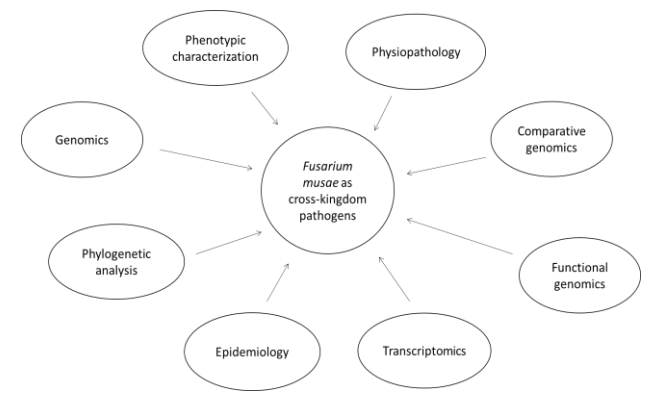
1. State of the art

In the last years it is becoming plausible that fungi associated to the agricultural production (plant pathogen) might sometimes evolve the ability to jump from one host to another even belonging to a different kingdom. Conspicuous number of new pathogens of clinical interest have been isolated and identified as already known pathogens involved in plant infection, in this way they also become a direct threat to human health, causing direct infections. This implies that also plants can become an important source of novel infecting agents for humans. Understanding the mechanisms of infection of plant pathogens, especially when they evolve cross-kingdom ability can contribute to establishing novel standards of food safety which will have to consider also the risk caused by them. *Fusarium musae* is a pathogenic species belonging to the *Fusarium fujikuroi* species complex. It is a novel spices isolated only in 2011 (Van Hove et al., 2011), *F. musae* is the causative agent of the crown rot disease on banana fruits, but it also causes keratitis, skin infections and systemic infections in immunocompromised patients (Esposto et al., 2016; Kamel et al., 2016). This makes it an ideal model for the investigation of cross-kingdom pathogens.

2. Aim of the project

Use *F. musae* as model to study cross kingdom infections in the banana-human pathosystem by combining studies within different fields:

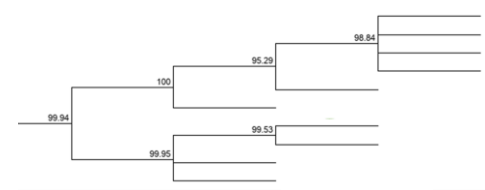
- characterisation of this novel species,
- document the known diversity,
- find determinants for the infection of different hosts.



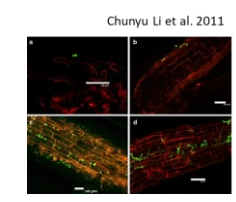
3. PhD thesis structure

Investigation of a worldwide collection of *F. musae* strains isolated from human patients and banana fruits:

1° step — Multigene sequencing → Phylogenetic position of the strains and physiological characteristics (as fitness, fungicide sensitivity)

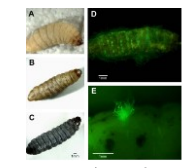


2° step — Development of luminescent and fluorescent strains → In vivo imaging and pathobiology of infection mechanisms

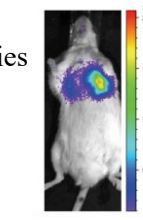


Banana fruits

Human proxies



Navarro-Velasco et al. 2011



M. Brock et al. 2011

3° step — Comparative transcriptomic analysis and functional genomics approaches → Genetic determinants for infections

4. Preliminary results

Four strains isolated in our laboratories from banana fruits and human patients identified at first as *Fusarium musae* were further investigated. The species attribution of the *F. musae* strains was confirm by MLST approach only for 3 strains while the fourth was reclassified as *F. verticillioides*. Phylogenetic tree was built and the position of our strains was confirmed within *F. musae* species as a group close to *F. verticillioides*. A collection was built and used to study the aggressiveness of this novel species and its susceptibility to both clinical and agricultural azole fungicides. Results showed a wide pattern of susceptibility, this suggested that an accurate identification at species level is also important to aid in the choice of an appropriate antifungal therapy, as well as in the detection of emergence of resistant strains, especially in epidemiological studies.

5. References

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