

The International Consortium in Advanced Biology presents:



# Biotic and Abiotic Stress Tolerance in Plants: the Challenge for the 21st Century

## BOOK OF ABSTRACTS

### 6 to 8 • NOVEMBER • 2013

### Cana Brava Resort • Ilhéus - Bahia - Brazil

[www.ciba2013.net](http://www.ciba2013.net)

supports:



organizing institutions:



## Workshop on Biotic and Abiotic Stress Tolerance in Plants: the Challenge for the 21st Century

Cana Brava Resort • Ilhéus-Bahia, Brazil • 6th-8th November 2013

### S02T03

#### Molecular and histological analysis of rice (*Oryza spp.*) - *Meloidogyne* interactions

A-S. Petitot<sup>1</sup>, P. Nguyen<sup>1</sup>, R. Haidar<sup>1</sup>, J. de Almeida-Engler<sup>2,3</sup>, M. Agbessi<sup>1</sup>, S. Bellafigliore<sup>1</sup>, K. Lambou<sup>1</sup>, A. Dereeper<sup>1</sup>, M. Beneventi<sup>1,3</sup>, I. Mezzalana<sup>1,3</sup>, P. Pelegri<sup>1,3</sup>, M-E. Lisei de Sá<sup>1,3</sup>, M. Grossi de Sá<sup>1,3</sup>, E. Freire<sup>3</sup>, MF. Grossi de Sá<sup>3</sup> and D. Fernandez<sup>1,3</sup>

<sup>1</sup>UMR 186 RPB (IRD-UM2-Cirad) 911, avenue Agropolis BP 64501 34394 Montpellier Cedex 5, France

<sup>2</sup>UMR Sophia AgroBiotec INRA/CNRS/UNS, 400, Route de Chappes BP167 F-06903 Sophia Antipolis CEDEX France

<sup>3</sup>LIMPP, EMBRAPA-Recursos Genéticos e Biotecnologia (Cenargen), CEP:70770-917, Brasília-DF, Brasil

Email : Diana.Fernandez@ird.fr

*Meloidogyne spp.* are responsible for rice (*Oryza sativa*) production losses in Asia, Latin America and Africa. All currently grown rice varieties are highly susceptible and resistance to root-knot nematode species is only found in the African rice relative species *Oryza glaberrima*. Currently, little is known at the molecular level about the monocotyledonous plants interactions with *Meloidogyne* species as most studies were performed on dicotyledonous hosts. The *M. graminicola* and *M. incognita* interaction with susceptible (*O. sativa* Nipponbare) and resistant (*O. glaberrima* TOG5681) rice plants were investigated by histological and molecular analyses. A reduced number of nematodes penetrated and persisted in resistant roots and the few nutrient feeding sites that formed in the vascular cylinder had their development arrested by ca. 20 days. RT-qPCR analyses of candidate genes involved in defense and hormonal-related pathways showed that they were activated in resistant plants, but repressed or less activated in the susceptible plants. These analyses suggest that the nematode is able to interfere with the rice immune responses, including the jasmonate/ethylene-dependent resistance pathway. In parallel, we are developing functional analysis and RNA-seq data mining for identifying nematode protein effectors that are expressed during infection for manipulating the host metabolism and suppress defense responses. These data provide with new insights into rice - *Meloidogyne* interactions. Identification of nematode virulence effectors and the plant resistance responses offer interesting perspectives for developing control strategies towards nematodes in rice.

Work supported by IRD, GIS-IBISA, Agropolis Fondation (France) - Embrapa, Capes, CNPq (Ciência Sem Fronteiras)

### S02T04

#### Identification of molecular markers associated to new sources of resistance to the root-knot nematode in cotton

M. Giband, P.A.V. Barroso, M.C. Moretzsohn, J-M. Lacape and R.M.D.G. Carneiro

Cirad UMR AGAP, Núcleo Cerrado da Embrapa Algodão, Rodovia GO-462, Km12, Zona Rural, 75.375-000, Santo Antônio de Goiás, GO, Brazil.

marc.giband@cirad.fr

The root-knot nematode (RKN) *Meloidogyne incognita* is a major constraint in cotton (*Gossypium hirsutum* L.) production in numerous countries. Control of RKN has been hampered by the lack of options for crop rotation and even more, by the lack of high-quality locally-adapted varieties exhibiting high levels of resistance. High levels of resistance occur in breeding lines, but the high level of resistance has not readily been transferred to cultivated varieties. Furthermore, cotton genetic improvement is based on the exploitation of a single source of resistance, making the crop vulnerable to the selection of resistant isolates. Resistance to RKN is also found in wild tetraploid cotton (*G. hirsutum* and *G. barbadense*) accessions that represent valuable resources for novel genes to be used for cotton improvement. Accessions of *Gossypium* spp. were evaluated for resistance to RKN in greenhouse experiments, and a highly resistant accession of *G. barbadense* displaying significant reduction in nematode reproduction was identified. Histological observations of this highly resistant *G. barbadense* accession (CIR1348) showed that resistance occurs through a two-stage mechanism involving a hypersensitive-like response. Accession CIR1348 showed high levels of resistance to various isolates of RKN originating from the major cotton-producing regions of Brazil. Genetic analyses indicate that resistance is recessive, and controlled by two major genes. The highly resistant accession CIR1348 was crossed with a susceptible cultivated variety (FiberMax966) to produce an F<sub>2</sub> mapping population and to

## **Workshop on Biotic and Abiotic Stress Tolerance in Plants: the Challenge for the 21st Century**

Cana Brava Resort • Ilhéus-Bahia, Brazil • 6th-8th November 2013

initiate the introgression of resistance into an adapted genetic background. The QTL analysis identified 2 major QTLs: one QTL is localized on chromosome 11, previously reported to harbor RKN-resistance loci in other sources of resistance, while the second one resides on a chromosome not previously identified as harboring RKN resistance genes/loci. The identification of SSR markers associated with the 2 major QTLs involved in RKN resistance paves the way to the marker-assisted introgression of the new source of resistance identified in cotton accession CIR1348. The genotyping of BC<sub>1</sub> plants is underway to identify those plants harboring the desired allelic combination at the loci of interest.

This work is supported by Embrapa (Macroprograma 2 – Convênio Embrapa/Monsanto) and CNPq

### **S02T05**

#### **Cassava phenotyping for drought adaptation**

*Maurício A. Coelho*

*Embrapa CNPMF-Brazil*

### **S02T06**

#### **The plant cytoskeleton is targeted by nematodes during parasitism and can be maneuvered to trigger resistance**

*Janice de Almeida Engler, Natalia Rodiuc, Mohamed Youssef Banora and Gilbert Engler*

UMR ISA INRA/CNRS/UNS, 400, Route de Chappes BP167 F-06903 Sophia Antipolis CEDEX France

Email : [Janice.Almeida-Engler@sophia.inra.fr](mailto:Janice.Almeida-Engler@sophia.inra.fr)

Sedentary endoparasitic nematodes are pathogens that are capable to alter plant root cells by inducing specialized feeding structures. Signals from root-knot nematodes (RKN) induce the formation of specialized hypertrophied multinucleated feeding cells within the plant roots, called giant-feeding cells. *In vivo* observation of GFP-decorated microtubules and actin filaments and immunocytochemical studies revealed that severe changes of the cytoskeleton occur during nematode-induced feeding cell development. Our results reveal that endoplasmic microtubules as well as actin filaments are disordered and most likely undergo partial depolymerization during giant cells development. As well, mitotic arrays are disturbed and malformed possibly causing abortion in cytokinesis. This major rearrangement has been further evidenced using cytoskeleton inhibitors and by functional analysis. Results indicate that a partial depolymerization of the cytoskeleton possibly facilitates nematode feeding. Functional studies validated prior results and revealed the involvement of ADF (Actin Depolymerizing Factor) proteins in the rearrangement of the plant actin cytoskeleton in giant cells. Our results suggest that actin depolymerizing factor proteins are involved in the control of actin cytoskeleton rearrangement in feeding cells and ADF2 is essential for proper giant cell development. We have also investigated the implication of  $\gamma$ - tubulins during feeding cell development and data revealed that  $\gamma$ -tubulin recruitment contributes to microtubule nucleation in mitotic and cortical arrays of RKN induced giant-feeding cells. Overall, our data demonstrated that the plant cytoskeleton is targeted by nematodes during parasitism and can be envisaged to be maneuvered to trigger resistance.

Work supported by VIB and INRA.

### **S02T07**

#### **Effects of metals on morphology, ultrastructure, mineral nutrition and compartmentalization in tropical plants**

*T.A. de Freitas, Alex-Aan, F. de Almeida, R de Jesus, Silva, D.C., J.V dos S, Silva, J da S, Fernandes, P.A. Mangabeira*

*Universidade Estadual de Santa Cruz, Departamento de Ciências Biológicas, Rodovia Jorge Amado s/n Salobrinho Ilhéus, Bahia, Brazil, CEP 45662900*

Email : [pamangabeira@uesc.br](mailto:pamangabeira@uesc.br)

In the past few years, metal pollution has become one of the most important environmental problems. Concerning the high toxicity of these elements, both sensitive analytical measurements and methods for the control of the ecosystem are required to reveal and localize metals on organisms. This study aimed to evaluate the major anatomic and ultrastructural changes in tissue and cellular level, respectively, in leaves and roots and quantify the content of minerals nutrient in roots, stems and leaves