

Title: On the date palm-*Fusarium oxysporum albedinis* interaction : Elicitation of the defense reactions and development of new biocontrol strategies of the bayoud disease

Majida El Hassni, Fatima Jaiti, Abdelhy Dihazi and Ismail El Hadrami*

Laboratoire de Biotechnologies, Protection et Valorisation des Ressources Végétales (Biotec-VRV), Faculté des Sciences Semlalia, B.P. 2390, 40 000 Marrakech-Maroc.

E-mail: hadrami@ucam.ac.ma ; hadramii@hotmail.com

The aim of the present communication was to summarize 20 years working on the pathosystem date palm-*Fusarium oxysporum albedinis* (Foa), the agent causing Bayoud disease (*El Hadrami 1995; El Hadrami et al., 1997; Ramos et al., 1997; Dihazi et al., 2003; Daayf et al., 2003; Bouizgarne et al., 2004; El Hassni 2005; Jaiti, 2008; El Hassni et al., 2004, 2005, 2007; El Hadrami et al., 2005; Bounnit 2007; Mohcine 2009; Jaiti et al., 2004, 2007; 2008; 2009; El Hadrami and El Hadrami, 2009; others publications and communications on the subject*). It deals mainly with the induction of the defense reactions in date palm seedlings against Foa. Several strategies have been developed to study the elicitation of the defense reactions at the root level comparing some interesting date palm genotypes on the base of their resistance or not to the pathogen.

The first part of this work consisted to elicit defense reactions in roots with an hypoaggressive isolate of *Fusarium oxysporum* (AHD). This elicitation was translated by the protection of seedlings against infection by aggressive isolate ZAG of Foa. This protection was correlated with the ability of AHD isolate to induce peroxidases and polyphenoloxidases activities as well as the accumulation of non constitutive hydroxycinnamic acid derivatives. Indeed, it was revealed that pretreatment of seedlings with AHD enhanced a faster enzymatic activities to reach a higher levels as obtained after inoculation by aggressive ZAG isolate in seedlings of JHL cultivar (susceptible) and to the same levels in BSTN cultivar (resistant). Histochemical analysis revealed that peroxidase activity was observed in cell walls, intercellular space and in cytoplasm. Moreover, histochemical localization of polyphenoloxidase was revealed as black vesicles, which could be attributed to plasts.

This variation of metabolic response translating a certain cellular immunization was also revealed concerning phenolic compounds. Indeed, inoculation with AHD induced an increase of caffeoylshikimic acids amounts and an accumulation of non constitutive hydroxycinnamic acid derivatives in which a sinapic derivative was the

major compounds. Furthermore, inoculation with ZAG induced, after 2 weeks, a decrease or the disappearance of caffeoylshikimic acids accompanied with a massive accumulation of sinapic derivative. Seedlings pretreated with AHD accumulated rapidly a high amount of the sinapic derivative.

In the second part of this work, four bacteria, *Bacillus pumilus* W1, *Bacillus cereus* X16, *Rahnella aquatilis* W2 and not yet identified S1 selected among 21 microorganisms have exhibited a high inhibition toward mycelial growth of Foa (70-77%) and its sporulation (80 - 95%). Microscopic observations of Foa mycelium harvested in the periphery of Foa colonies on the side of the antagonists revealed coagulation of cytoplasm and "formation" of large vacuoles. These 4 antagonists in addition to *Bacillus subtilis* B1 and *Pseudomonas* sp. P1 have presented the potential in the induction and synthesis of non constitutive hydroxycinnamic acid derivatives into roots of seedlings. This accumulation depends on the antagonist and the time of incubation. It's more revealed in BSTN cultivar after treatment by *Rahnella aquatilis* W2, *Bacillus subtilis* B1, *Bacillus pumilus* W1 and by the microorganism S1 not yet identified.

The third part of this work deals with the study of the role of chitosan in date palm-Foa pathosystem. The concentration of 1mg/ml of chitosan reduced the growth of Foa on PDA medium by an average of 75%, while mycelia growth was totally inhibited in Czapeck liquid medium after 8 days of culture and caused morphological changes in Foa mycelium. In addition, when injected in roots, chitosan elicited peroxidases and polyphenoloxidases activities and induced accumulation of non constitutive hydroxycinnamic acid derivatives. Pretreatment of seedlings by chitosan after Foa inoculation was translated by reduction of mortality in comparison with plants not treated.

Elicitation of defense reactions by hypoaggressive isolate of *Fusarium oxysporum* AHD, bacteria antagonists or chitosan as well as by other 'biological' strategies such as the treatment by 'Stifenia, a powder obtained from seeds of *Trigonella foenum-graecum*: Fenugreek' and by arbuscular mycorrhizal fungi translate the phenomenon of date palm seedlings 'immunization' against Foa. Such strategies could be applied as a novel approach in the control of Bayoud disease in date palm.

Key words: date palm, *Fusarium oxysporum albedinis*, *Fusarium oxysporum*, antagonists, chitosan, biological control, priming, peroxidases, polyphenoloxidase, phenolic compounds, phytoalexins, toxins.