ABSTRACT

Abed Abd Algaleel Ata: Variability of *Uromyces betae*, the Cause of Sugar Beet Rust and Its Control. Unpublished Ph.D. Thesis, Department of Plant Pathology, Faculty of Agriculture, Ain Shams University, 2009.

Beet rust disease incited by *Uromyces betae* Tul. ex Kick is considered among the most destructive diseases attacking sugar beet causing quantitave and qualitative losses of yield world wide and Egypt.

Rust spores on beet infected trash or carried on/ in contaminating imported seeds could not be considered as a primary source of inoculum, so it is probable that, the first spores of *U. betae* reach sugar beet in winter are windborne spores produced on beet in European countries in late autumn.

Twenty three isolates of *U. betae* were collected from different locations in four governorates of Egypt and used in the present study to evaluate the genetic diversity among the fungus isolates using SDS-Protein Electrophoresis and Random Amplified polymorphic DNA (RAPD) analysis.

Total protein electrophoresis analysis exhibited 85.714% polymorphism among the twenty three tested isolates. Fourteen different protein bands were detected; two of them were recorded as monomorphic bands, in addition three bands were recorded as isolate specific bands.

Dendrogram analysis based on total protein polymorphism separated the twenty three tested isolates into two main groups at approximately 26 % dissimilarity. There was no correlation between clustering in the protein dendrogram and geographic origin of the tested isolates.

Results of this study suggested that protein profiles data can differentiate *U. betae* isolates. The RAPD analysis with primer OP2 in a preliminary study gave twenty polymorphic bands. It showed 100 % polymorphism among the twenty three

tested isolates; in addition five bands were recorded as isolate-specific bands. These isolate-specific markers could distinguish four isolates out of the twenty three. Dendrogram analysis based on DNA polymorphism with primer OP2 separated the twenty three tested isolates into three main groups at approximately 26 % dissimilarity.

The RAPD analysis with the six primers in a complementary study gave 56 different DNA fragment bands with wide molecular weights. Thirteen of them were expressed as isolate-specific bands and could distinguish seven isolates out of the fourteen tested isolates. The complied data for the six primers recorded 98.33 % polymorphism among the fourteen tested isolates.

Dendrogram analysis based on DNA polymorphism of the six primers separate isolate No. 2 from the tested isolates at dissimilarity 25 % and divided the reaming isolates into two main groups at approximately dissimilarity 16 %.

RAPD groups were not associated with geographic origin of the tested isolates.

Among five chemical inducers evaluated for their capabilities to induce resistance against beet rust in greenhouse and field trials during 2006/ 07 growing season in Damietta and Kafr El-Sheikh governorates, Hydrogen peroxide at 1.0 % and 0.5 %, salicylic acid and di-basic potassium phosphate at 8 mM were the most effective treatments. Moreover these inducers recoded the highest sucrose, quality percentage and maximum reduction of non-sucrose chemical components. Hydrogen peroxide, at 1.0 % showed the highest level of oxidative enzymes (PO, PPO, PAL and TAL) activity. The higher free phenols and lignin contents were recorded by hydrogen peroxide 1.0 % and salicylic acid at 8 mM.

Among five microelements and their mixture evaluated for their efficacy to induce resistance against beet rust, the most

effective microelements were the mixture at 400 and 200 ppm and Boron at 400 ppm. The highest sucrose, quality percentage and the maximum reduction of non-sucrose chemical compounds were obtained by B at 400 ppm. Microelement's mixture at 400 ppm induced the highest level of oxidative enzymes (PO, PPO, PAL and TAL) activity followed by Band Fe at 400 ppm. Maximum amounts of free phenols and lignin were observed in leaves sprayed with the mixture followed by B, Mn and Zn at 400 ppm.

Among three growth regulators, ethephon at 0.80 % followed by indole butric acid at 50 ppm were the most effective treatments. These inducers also increased sucrose, quality percentage and decreased non-sucrose chemical components. Ethephon at 0.80 % showed the highest level of oxidative enzymes (PO and PPO). Higher free phenols and lignin contents were recorded by ethephon at 0.80 %.

Among twelve isolates of different bio-agents isolated from the phylloplane of healthy leaves of sugar beet plants or from different hosts and three bio-fungicides, *Bacillus pumilus* and *Pseudomonas fluorescens* isolated from the phylloplane of healthy leaves of sugar beet plant grown in heavily infected fields were the most effective bio-agents. These isolates significantly increased root weight/ plant, recorded the highest percentage of sucrose and juice quality and reduced non-sucrose chemical components.

Key words :

Sugar beet (*Beta vulgaris*), rust, *Uromyces betae*, source of primer infection, SDS-Protein Electrophoresis, PCR, RAPD, induced resistance, H_2O_2, SA, KH_2PO_4, K_2HPO_4, Bion (BTH), Mn, Zn, B, Fe, Cu, GA_3, IBA, ethephon, biological control, *Bacillus subtilis*, *B. pumilus*, *B. mycoides* and *Pseudomonas fluorescens*.

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