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*Editors*

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# The Development of Agricultural Biotechnology Capacities in Palestine through the UNESCO Biotechnology Educational and Training Center at Bethlehem University

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## Introduction

Attempting to promote the development of agricultural biotechnology and plant molecular biology in developing countries of the world, Prof. Indra Vasil (University of Florida, USA) the former chairman of the UNESCO Biotechnology Action Council (UNESCO BAC) established, about 10 years ago, five biotechnology educational and training centers (BETCEN) in regions of developing countries in the world including China, Mexico, Hungary, South Africa, and Palestine. The mission of these centers is to promote the development of biotechnology research and build, through educational and training activities a well trained man power capable of conduction of modern research in plant molecular biology and agricultural biotechnology. During the first 3 years of activity, the UNESCO BETCEN in Palestine was granted about \$200,000 from the UNESCO BAC to finance educational and training activities and to support small-scale research projects in Palestine and Arab countries. In addition, the center received, in subsequent years, research grants of about \$1.2 million from American and German funding

agencies to finance five research projects in plant biotechnology in collaboration with Israeli, Arab, and German research institutes. In this paper, we briefly report about the educational and research activities held in this center during the last decade, as well as about the outcomes of some of the completed research projects and their current application in the Palestinian agriculture.

### **Educational activities and research fellowships**

Our educational activity involved the following; first, courses and workshops on Plant Tissue Culture Techniques, delivered by the late Prof. Abed Watad from the Agricultural Research Organization (ARO), Israel, and Prof. Hassan Abu-Qauod from An-Najah National University, Palestine. Second, workshops on Plant Viral Diseases and Detection of Plant Viruses by Electron Microscopy, was given by Prof. Abed Gera and Prof. Sara Spiegle, both from ARO, Israel. Third, an intensive course on Biological Control and a workshop on The Use of Entomopathogenic Nematodes as a Biocontrol Agent. These two educational activities were given by Prof. Ralf-Udo Ehlers and his team from the University of Kiel in Germany. In addition, our team held several introductory courses on biotechnology and biological control addressed to high school, and undergraduate students in the West Bank. The total number of scientists from Palestine, Jordan, Egypt, and Morocco participated in all courses and workshops exceeded 300. In addition to this educational activity, our UNESCO BETCEN awarded sixteen research fellowships, each of \$5000, to students in Palestine, Lebanon, Morocco, Tunisia, and Egypt to support research on plant biotechnology.

### **Research work and the development of biotechnology capacities**

In 1998, our laboratory started an intensive research work involving multilateral scientific collaboration within the frame of several research projects financed by American and German funding agencies. The first project involved development of a regional viral indexing

and certification program for plant propagation material in the Middle East. The work was collaborated with laboratories from seven countries in the Middle East including; Palestine, Israel, Jordan, Lebanon, Egypt, Tunisia, and Morocco. The work of our team focused on development of serological and molecular techniques for the detection of viruses in grapevine, citrus, and potatoes. The project was financed by the U.S. Agency for International Development (USAID) for a period of 5 years. The second project dealt with studying the molecular basis for pathogenicity of *Clavibacter michiganensis* subsp. *michiganensis*, *Erwinia herbicola* pv. *gypsophilae* and *E. herbicola* pv. *betae* and its application for diagnosis. The main part of our work in this project focused on application of diagnosis methods based on PCR amplification of parts of the bacterial pathogenicity genes using specific primers. The work was collaborated with one laboratory at the University of Bielefeld, Germany, and another two laboratories in Israel. The third project, also financed by the DFG, Germany, studied the evolutionary divergence, reproductive biology and conservation of the royal irises *Iris* section *Oncocyclus*. The research work was in collaboration with the University of Mainz in Germany and the Hebrew University of Jerusalem in Israel. The work of our team involved evaluation of levels of genetic diversity within populations of two endangered species of irises in the West Bank and Israel ; *Iris haynei* and *I. atrofusca* using random amplified polymorphic DNA (RAPD) for the assessment of the taxonomic status of these two taxa in order to recommend appropriate conservation measures.

The knowledge and expertise acquired by our team through work on the above topics, constituted a solid basis for the establishment of a well-equipped diagnostics laboratory for the detection of bacterial and viral phytopathogens. This laboratory is the sole phytopathogen diagnostics facility available in Palestine. The Palestinian Ministry of Agriculture utilizes the services of this laboratory for a nationwide annual screening of grapevine, citrus, and stone fruit seedlings for the occurrence of viral and bacterial pathogens. The annual survey is important for implementing the required quarantine measures.

The fourth research project conducted in our laboratory involved research on insect-pathogenic nematodes and their use for the control

of white grubs (*Maladera matrida*) in the Middle East. We have isolated and identified ten strains of nematodes by means of molecular methods involving restriction digestion and DNA sequence homology of part of the nematode genome. One of our isolates is possibly a novel species. In addition, we applied two of our isolates for the control of white grubs in fields of sweet potato in Gaza. This project was financed by the DFG, Germany and collaborated with ARO, Israel, and University of Kiel, Germany. The fifth project deals with development of tomatoes with combined resistance to Tomato Yellow Leaf Curl virus (TYLCV) using both virus-derived resistance and molecular marker-assisted breeding. The funding and collaboration are as those mentioned for the first project. We have succeeded to develop a transgenic tomato plant resistant to TYLCV.