REPUBLIC OF CROATIA
MINISTRY OF SCIENCE, EDUCATION AND SPORTS

UNITY THROUGH KNOWLEDGE FUND

Project title

The landscape genetics of the invasive western corn rootworm in Croatia

Financing: *Ministry of Science, Education and Sport represented by the Unity through Knowledge Fund's Approval Committee on the allocation of financial support within Croatian Science and Technology Project under the Loan Agreement Nr. 7320-HR between Republic of Croatia and International Bank for Reconstruction and Development (Narodne Novine, Međunarodni ugovori br: 12, Loan Nr. 7320-HR).*

PROJECT DESCRIPTION

Summary of the purpose of the visit

The purpose of this project is to provide data that will help in the control of the western corn rootworm (WCR) in Croatia. The WCR *Diabrotica virgifera virgifera* (Coleoptera: Chrysomelidae) is a highly invasive pest of corn, which was introduced to Europe in the early 1990s from the United States of America (USA). It is now a serious pest of maize in Europe, including Croatia. Successful control efforts require a detailed understanding of the mechanisms underlying invasion success, and these can be investigated by the field of landscape genetics. Understanding the landscape genetics of WCR in Croatia will: increase knowledge of how many populations exist; enhance understanding of WCR dispersal including where and when a WCR invasion is likely to occur; how populations might spread; the level of genetic diversity in populations; and assess the level of spatial and landscape dependence on the genetic structure, gene flow and dispersal of WCR. Therefore, providing data that will assist in selecting the most appropriate WCR control method (i.e. chemical control, crop rotation, tolerant maize varieties, cultural practices, etc.) for specific landscape types in Croatia. Thus, making Croatia a world leader in DNA based dispersal studies of WCR using landscape genetics.

Applicant, co-applicant and other collaborators involved

a. Applicants

Main applicant		***Co-applicant (mandatory)***	
Family name:	Mikac	Family name:	Bažok
First name(s):	Katarina Maryann	First name(s):	Renata
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Job description	Associate Lecturer	Job description	Professor
Time to be spent (F.T.E.):	1.0		1.0

Description of the proposed visit

a. Rationale and background of the visit

The purpose of this project is to provide data that will help in the control of the WCR in Croatia. The WCR is a highly invasive pest of corn, which was introduced to Europe in the early 1990s from the USA [1] where it is the worst pest of maize [2]. It is now a serious pest of maize in Europe, including Croatia. It is estimated that production losses and management costs associated with control of WCR (and the northern corn root worm, *D. virgifera barberi*) cost US$1 billion per year in the USA. Although the production losses and management costs associated with WCR in Europe have not been measured, they are certainly considerable. The spread of WCR to Europe has caused a flood of research into the biology, ecology and management of WCR in Europe [3, 4].

Intracontinental dispersal and transatlantic introductions of WCR to Europe continue [4]. The proposed research to investigate the landscape genetics of WCR is at the cutting edge of landscape ecology and population genetics, which have combined to form the new scientific field of landscape genetics. Genetic markers such as microsatellites when coupled with robust Bayesian spatial models [5, 6, 7] are a powerful means to demonstrate how landscapes influence genetic structure, gene flow and dispersal. The results of this research can be used to make informed management decisions in the advent of the development and spread of pesticide resistant WCR genotypes in Croatia.

b. Objectives, significance and contributed added value of the visit

1. Using microsatellite markers identify the landscape features that influence the historical and contemporary genetic structure of WCR populations from Croatia.

2. Using microsatellite markers identify the landscape features that influence the direction and magnitude of historical and contemporary gene flow and dispersal of WCR populations from Croatia.

3. Develop landscape specific national WCR integrated pest management (IPM) strategies using the genetic data obtained from objectives 1 and 2.

c. Expected measurable results of the visit (joint research grant application, staff training…)

- Collaborative field work during which Dr Mikac will learn important field skills from Prof. Bažok at the University of Zagreb (UZ), Faculty of Agriculture (AFZ);
- Laboratory work in which Dr Mikac will train Prof. Bažok and other researchers and students at the AFZ in landscape and population genetic laboratory methods;
- Dr Mikac will develop, coordinate and deliver landscape and population genetic workshops at the AFZ to instruct Prof. Bažok and other researchers and students on the genetic and statistical theory that underpins these disciplines;
- Multi-institutional cooperative research and exchange of ideas with researchers who are part of the *Diabrotica* Genetics Consortium [8] which will result in using data from the current UKF project proposal to apply for the EU Seventh Framework Program (FP7) for investigations into WCR genetics. In the new FP7 project the AFZ (ie. Prof. Bažok and Dr Mikac) will collaborate on at least one work package and will be the leaders of one work package.
- It is anticipated that approximately five joint publications will arise from the proposed research

d. Relevance and potential benefit of the project to the development of Croatia

It is mandatory for Croatia to establish genetic capabilities as a scientific weapon to fight the WCR, which continues to infest and invade Croatian corn crops. Given that Croatia was one of the first countries to be invaded following its introduction to Europe [1] it is imperative that Croatia recognize the importance of genetics in answering fundamental questions relating to WCR dispersal, gene flow and genetic population structure and the potential natural barriers that landscapes may provide to their dispersal. Without the practical genetic knowledge that Dr Mikac will transfer to Prof. Bažok at the AFZ, the ability of Croatian researchers to effectively compete on a global scale with others conducting similar research is diminished. Through the establishment of genetic capabilities at the AFZ in Prof. Bažok's research group, scientifically robust and meaningful data will result, thus enabling the AFZ and Croatia to make an influential and lasting contribution to International and European research.

PROJECT RESULTS

The objectives listed from the initial application were as follows:

1. Using microsatellite markers identify the landscape features that influence the historical and contemporary genetic structure of WCR populations from Croatia.
2. Using microsatellite markers identify the landscape features that influence the direction and magnitude of historical and contemporary gene flow and dispersal of WCR populations from Croatia.
3. Develop landscape specific national WCR integrated pest management (IPM) strategies using the genetic data obtained from objectives 1 and 2.

Objectives 1 to 3 were the focus of the visit to the University of Zagreb (UZ), Faculty of Agriculture, Department for Agricultural Zoology. Objectives 1 and 2 have been partially met with results from the contemporary genetic structure and gene flow of WCR populations from Croatia available. Specifically we found non significant low levels of genetic differentiation among WCR populations in Croatia. This is indicative of high levels of individual movement (gene flow) among populations with no barriers to dispersal at distances of 0.5-134km. Currently, data to elucidate the historical genetic structure and gene flow of WCR populations from Croatia is being generated in the genetics laboratory at the Faculty of Agriculture, UZ. Data to describe the historical genetic structure and gene flow of WCR populations from Croatia will be available in the next 6 months. Once all the data is generated and compiled it will be possible to meet objective 3. As such, objective 3 will be achieved with 12 months.