"Sustainable development in Europe – cooperation between science and practice - What's the position of Central and South Eastern Europe?", 14-16 May 2017
Warsaw University of Life Sciences, Poland

Innovative and modern monitoring techniques - essential tool for effective pest control management

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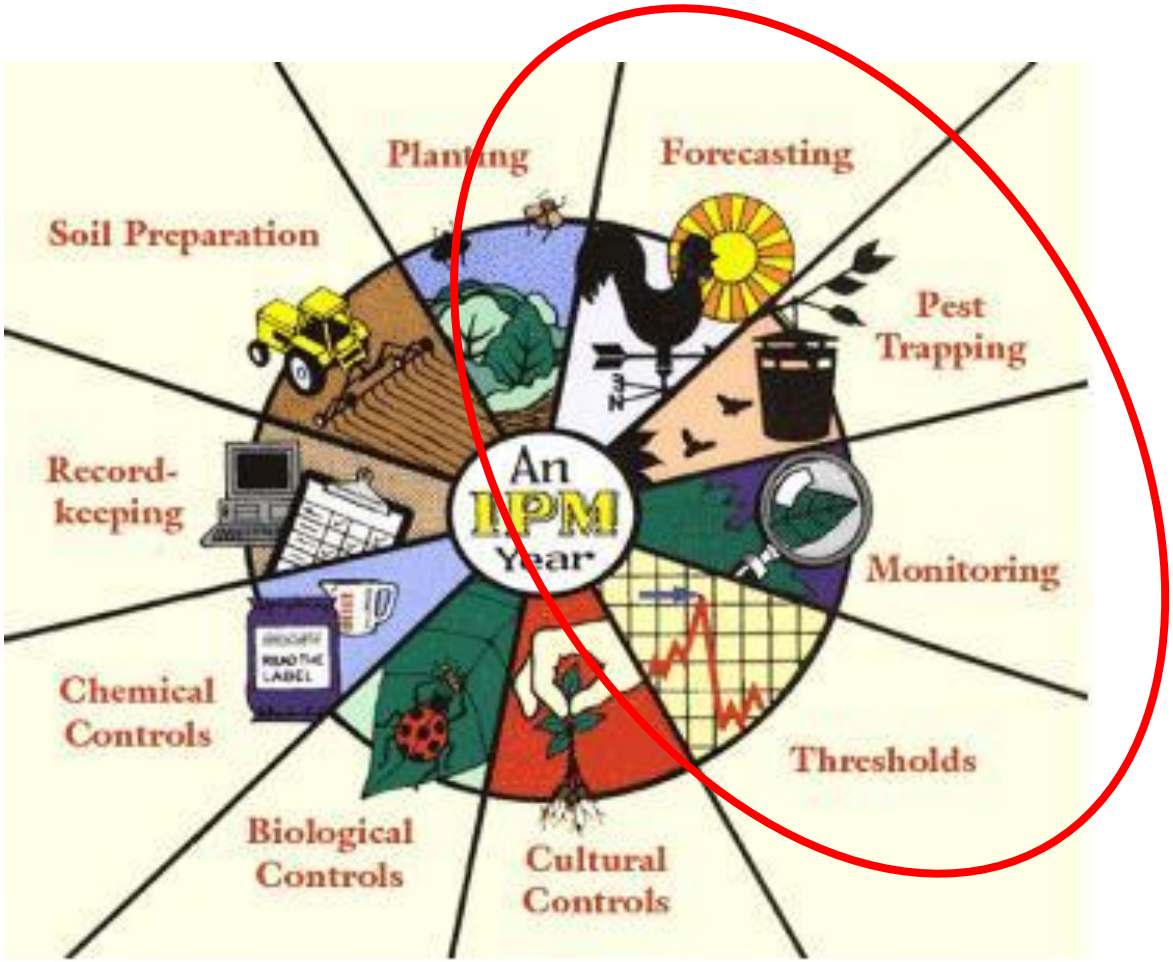
What is IPM ???


KNOWLEDGE
Pest Awareness
Inspection
Monitoring
PREVENTION
Exclusion Structural
Defects
CLEANING
Pest Food Source
Spillge Damages
INTEGRATED PEST MANAGEMENT
CHEMICAL
Minimal
Low Toxicity
Precision
PHYSICAL
DEVICES
Flying Insect Light
Trap (FILT)
SANITATION
Wet & Dry
Santising

IPM

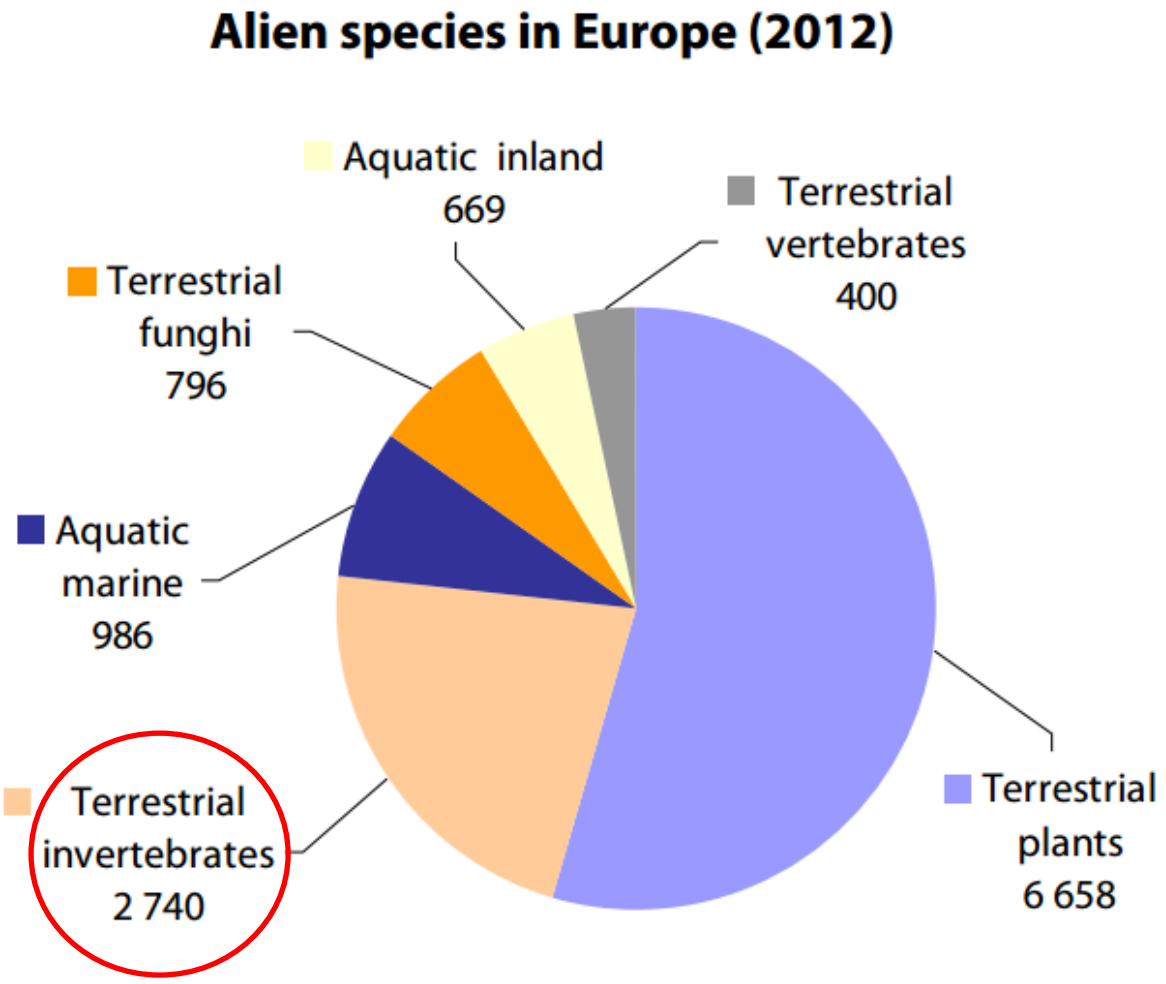


Monitoring means checking fields to identify which pests are present, how many there are, or what damage they've caused.

Correctly identifying the pest is key to knowing whether a pest is likely to become a problem and determining the best management strategy.

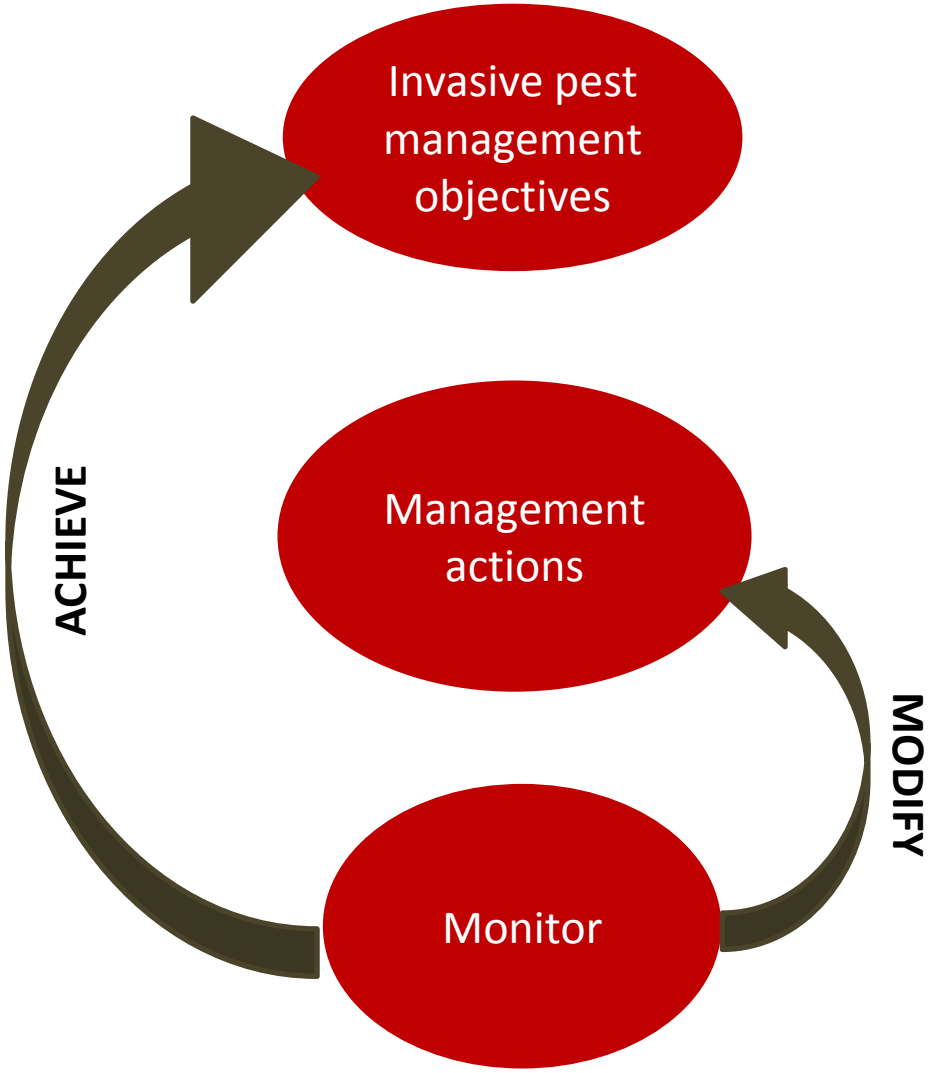
Invasive species

An **invasive species** is a species that does not occur naturally in a specific area and whose introduction does or is likely to cause economic (including agricultural) or environmental harm or harm to human health.



Why conduct monitoring??

- ✓ Monitoring can play an essential role in managing invasive pests - it provides nonbiased information to make well-informed management decisions.



Importance/Issues

Monitoring can be used to:

1. detect **new populations**
2. determine the status and temporal trends in **population sizes and distributions** over time (e.g., evaluate invasiveness)
3. determine **effects** of invasive species on ecosystem
4. measure **success** of best management practices (e.g., chemical control..) that are meant to prevent the introduction and spread of invasive pests into and throughout a management area

Type of Invasive Pest Monitoring

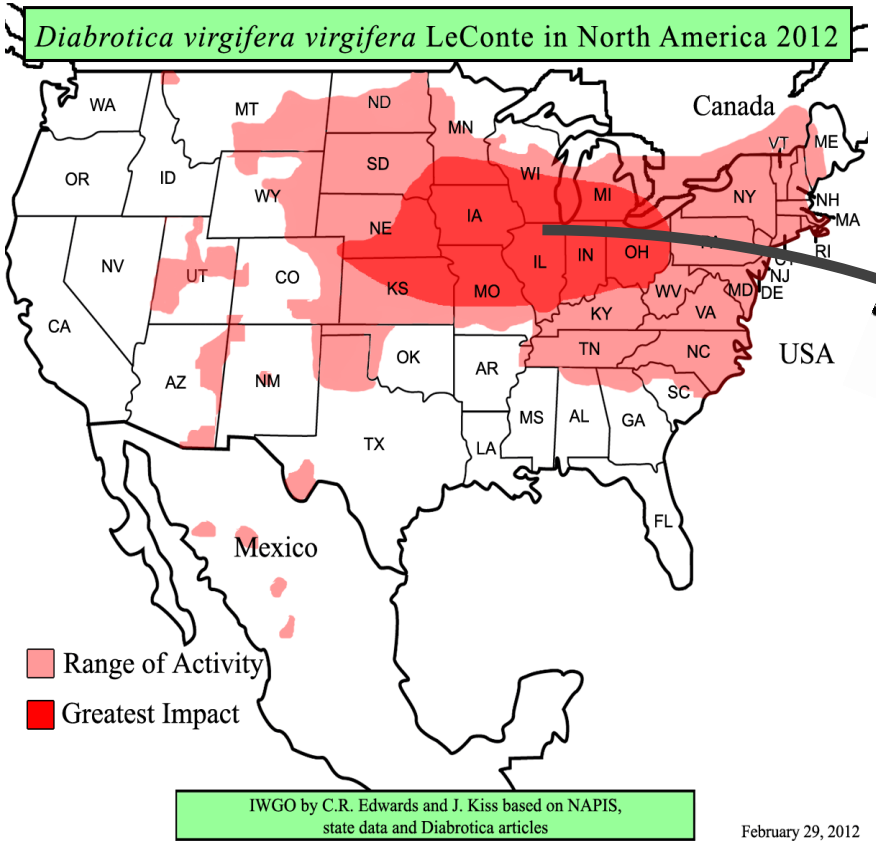
1. Monitoring for Early Detection

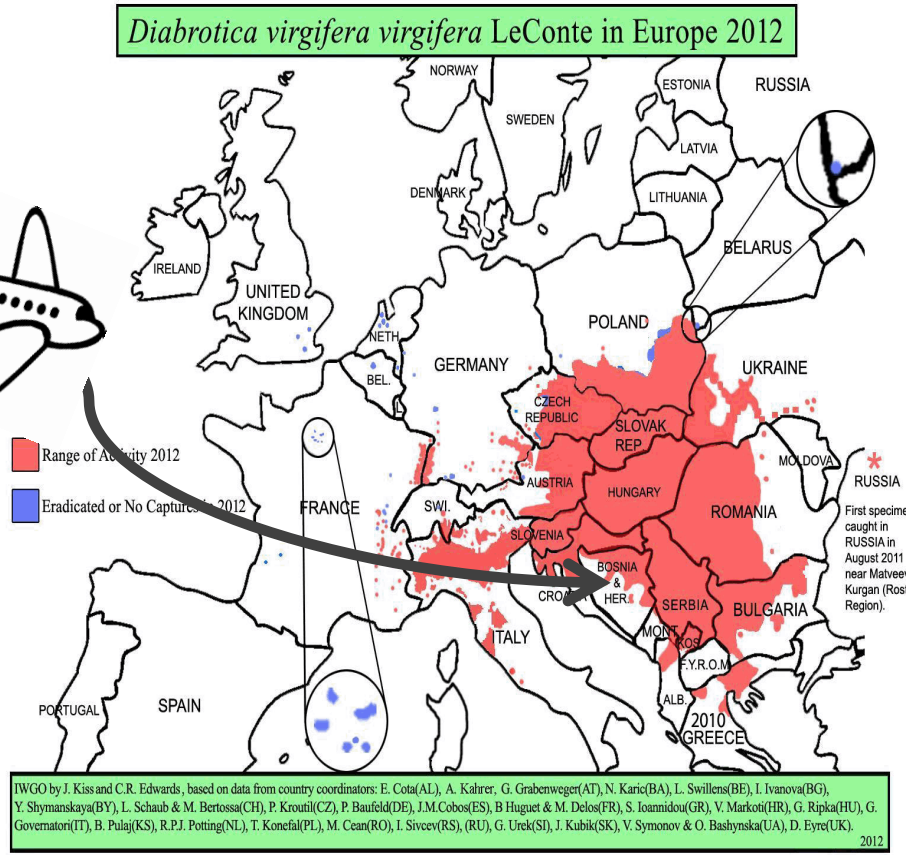
2. Monitoring for the Effect of Management Actions on Target Invasive Pests

Elements of a monitoring plan include:

- ✓ statement of problem
- ✓ monitoring objectives for target species (level of accuracy and precision)
- ✓ sampling design (to achieve monitoring objectives)
- ✓ field sampling methods
- ✓ data management and analyses
- ✓ evaluation of monitoring results
- ✓ adjustment of management actions

INVASIVE PEST INTRODUCTION





Invasive Pest

From Science to Field
Maize Case Study – Guide Number 2

Western Corn Rootworm In Europe: Integrated Pest Management Is The Only Sustainable Solution

Judit Papp Komáromi, Jozsef Kiss, Zoltán Pálinkás, Plant Protection Institute, Szent István University, Hungary (SZIU PPI); Stefan Toepfer, SZIU PPI, adjunct staff from CABI Europe, Switzerland

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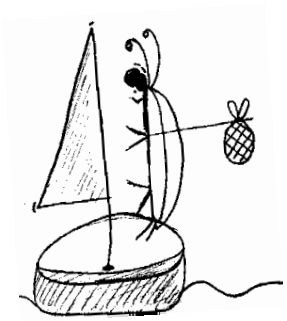
endure diversifying crop protection

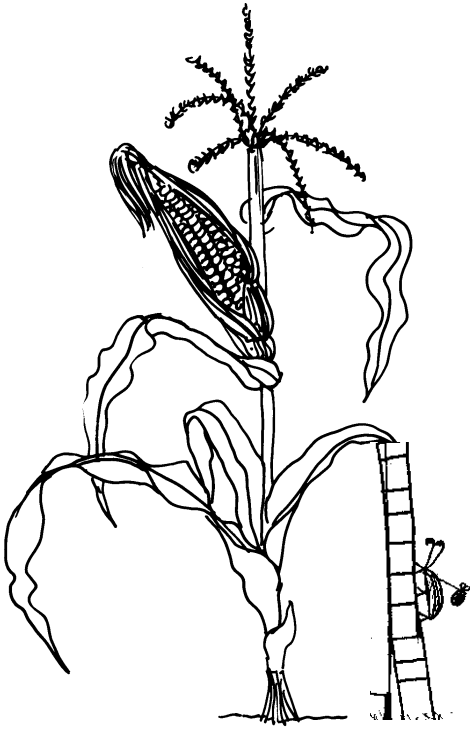
Food Quality and Safety
6TH FRAMEWORK PROGRAMME

INVASION PROCESS

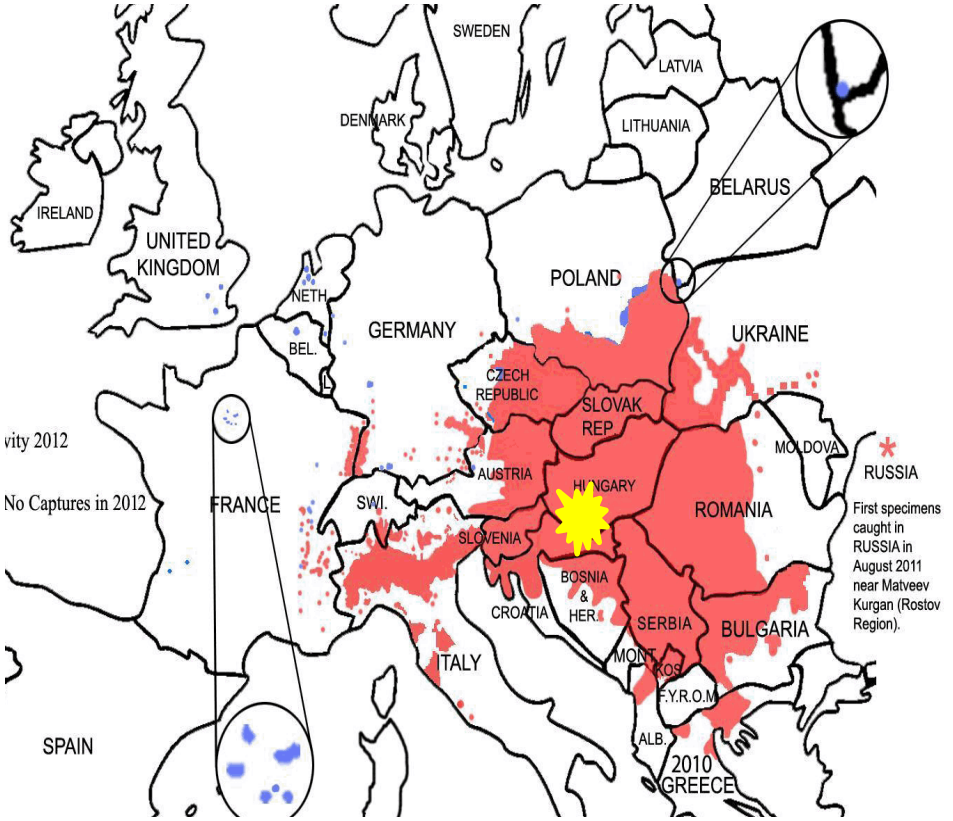


INTRODUCTION

1995.



ESTABLISHMENT



SPREAD

WCR IS PRESENT IN CORN GROWING REGIONS IN CROATIA AND Europe (400.000km^2)

PROBLEM

- The control and management of WCR is often hindered by a lack of understanding about their biology and ecology, including aspects of their invasion genetics.
- Determining the factors that positively or negatively affect or limit the growth of WCR populations will facilitate the development of IPM strategies aimed at slowing the spread and prevention of damage from potentially the most important pest of corn.

AIM

- TO monitor the movement of a invasive species
- TO predict its population abundance
- TO detect variation among populations

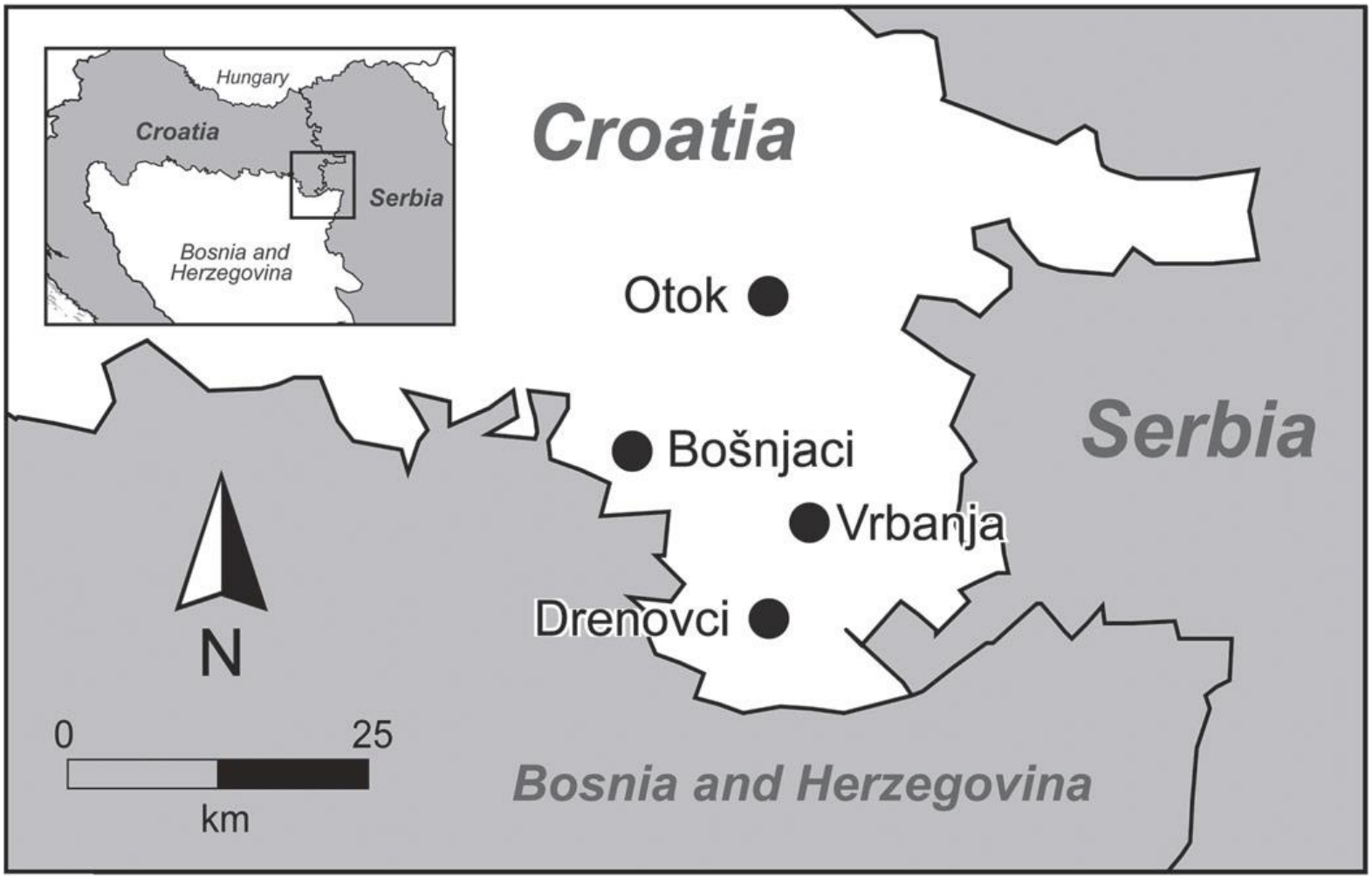
GOAL

✓ To understand if a control strategy have long term effectiveness

METHODS

- Our study combine different monitoring techniques to detect all possible changes that occur in invasion process of this species and to achieve better control and management.

LOCATION


Hungary
Croatia
Serbia
Bosnia and Herzegovina
Croatia
Otok
Bošnjaci
Vrbanja
Drenovci
Serbia
N
0
25
km
Bosnia and Herzegovina

MONITORING METHODS

- PHEROMONE TRAPPING

✓ possible to monitor the occurrence and abundance of the beetle to predict the damages it would inflict to corn crops in the following year

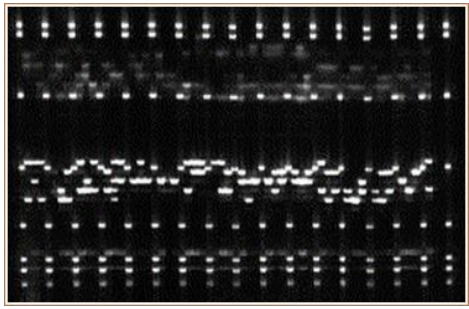
9 year period (1996-2004)

MONITORING METHODS

- POPULATION GENETICS

6 msat ‘core set’ loci

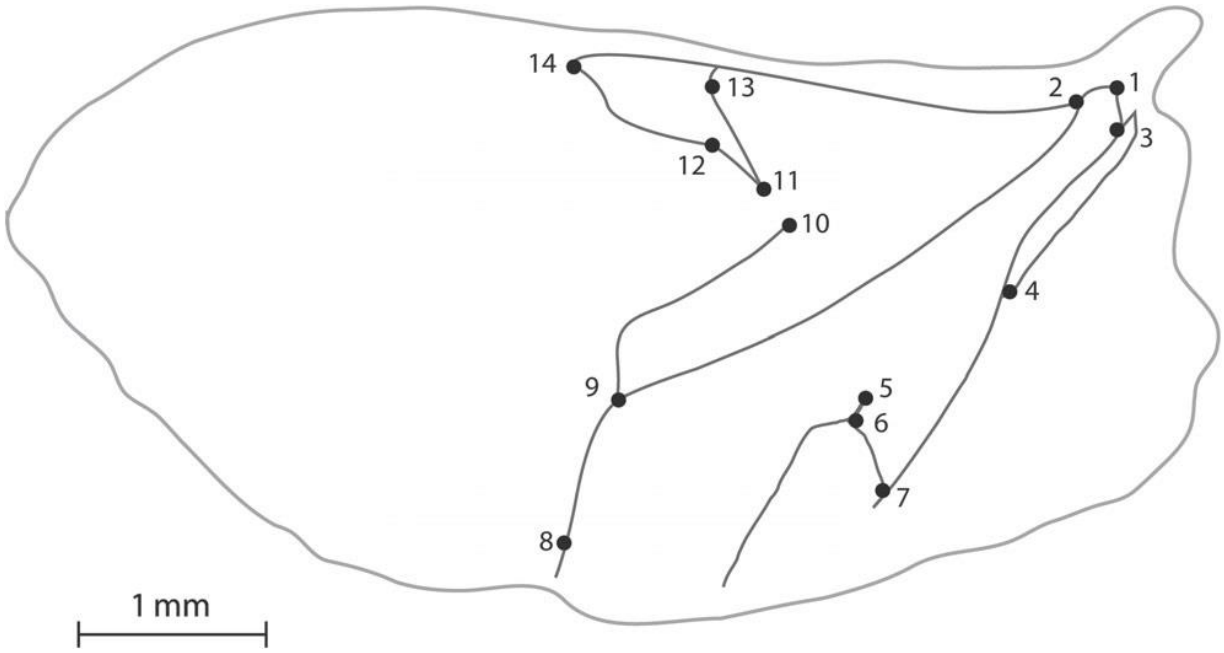
Individuals genotyped using ABI3100 Genetic Analyzer following methods of Kim *et al*. (2008)



samples from 1996 & 2009; n= 294

MONITORING METHODS

- GEOMETRIC MORPHOMETRICS



n=

60 males

60 females

120 left

120 right

Wing preparation (left/right)

14 landmarks digitized using TPSDIG v2.16 (Rohlf, 2008)

DATA ANALYSES

❖ GENETICS

✓ Tests of fit to Hardy-Weinberg equilibrium (HWE): **GENEPOP 3.4** (Raymond & Rousset, 1995a)

✓ Per locus estimates of: (1) number of alleles, (2) expected (H_E) & observed (H_O) heterozygosity, (3) Weir and Cockerham's (1984) F_{IS} (inbreeding co-efficient) & θ (F_{ST}): **FSTAT 2.9.3** (Goudet, 2001)

✓ Significant differentiation (Fisher exact tests) among populations for all loci & population pairs: **GENEPOP**

✓ θ (F_{ST}) calculated among population pairs: **FSTAT**

❖ GEOMETRIC MORPHOMETRICS

➢ Shape variation – ANOVA, PCA, CVA

➢ All morphometric & data analyses were performed using **MorphoJ v1.04a** (Klingenberg, 2011)

PHEROMONE TRAPPING

RESULTS & DISCUSSION

WCR capture numbers on pheromone trapping conducted in the region of Vukovar-Sirmium in the period 1996–2004

Year of monitoring	Number of beetles captured	Average number of beetles captured
1996	699	18
1997	2398	109
1998	4416	184

✓During the 9 years of WCR monitoring in the Vukovar-Sirmium region, 48 001 adults were captured on pheromone traps

✓Pheromone traps were found to be very sensitive for early detection purposes.

RESULTS & DISCUSSION

PHEROMONE TRAPPING

It has been estimated that WCR populations have an average dispersal rate of approximately 40 km/year and a growth rate that allows them to quadruple in abundance annually when inadequately controlled.

RESULTS & DISCUSSION

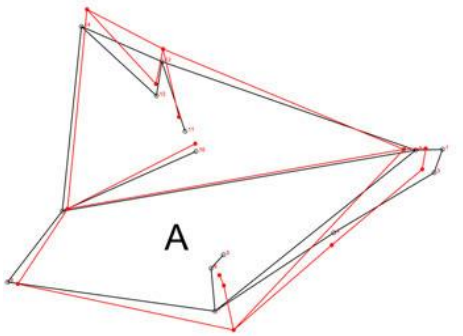
POPULATION GENETICS

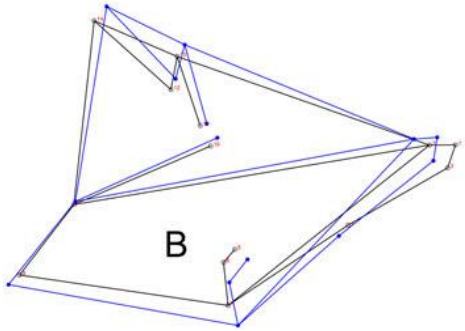
✓ GENETIC DIFFERENTIATION was low to moderate during the 15 years of monitoring

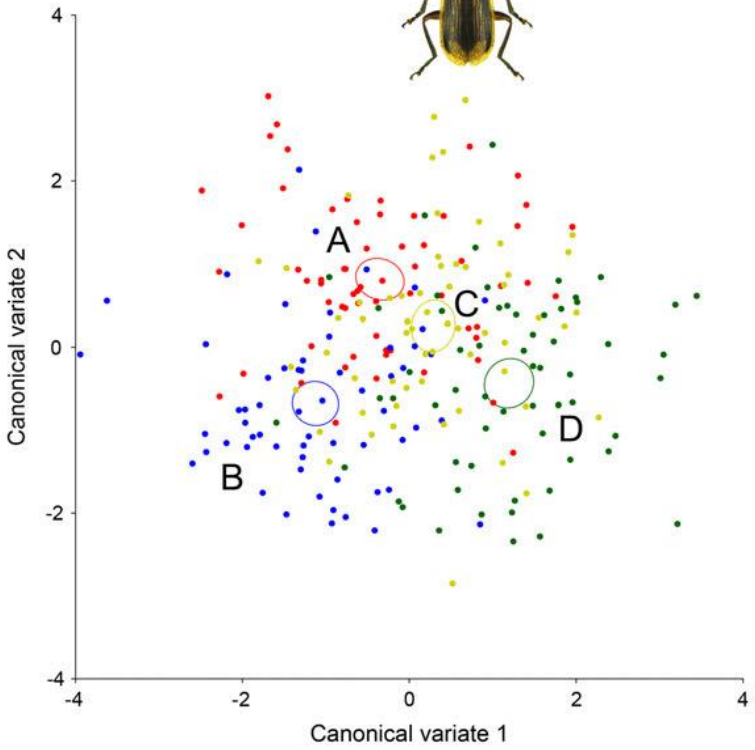
✓Poulations investigated are genetically similar and exist as a single large population in the Vukovar-Sirmium region

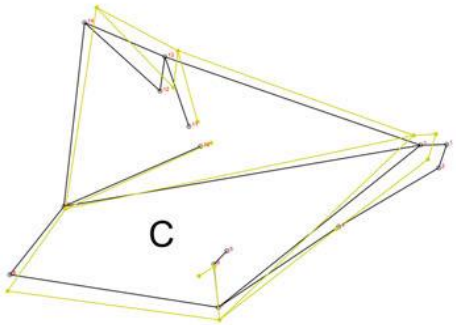
RESULTS & DISCUSSION

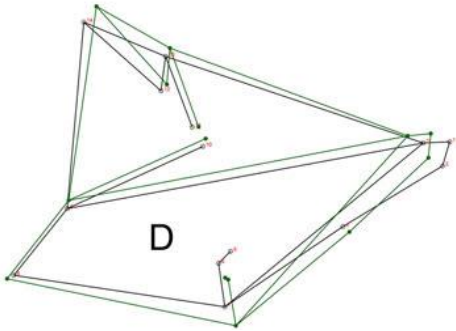
GEOMETRIC MORPHOMETRICS











✓Shape variation between population was highly signifficant.

CONCLUSIONS

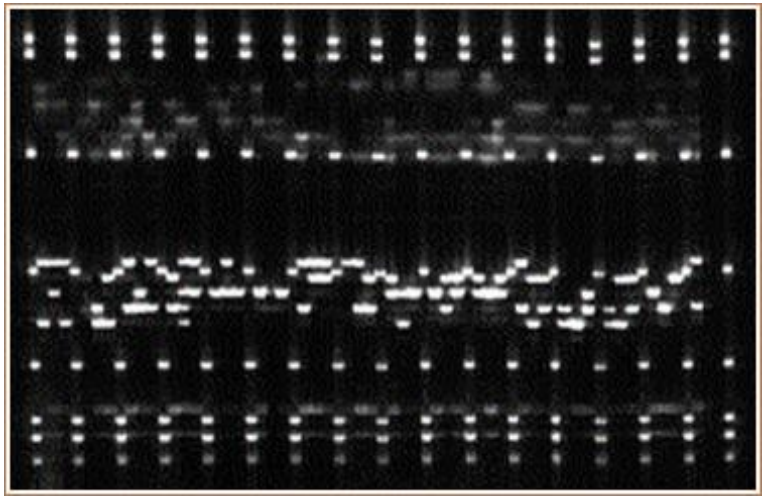
- Combinations of different monitoring techniques -> INTER POPULATION VARIATION

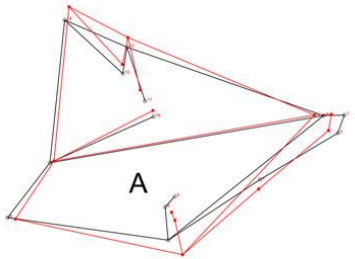
- Combined use of **traditional monitoring** (used to predict population abundance) + **novel-use** monitoring techniques such as genetics & GM) (used to detect pest behaviour) =

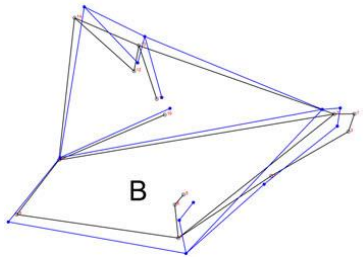
ESTIMATE VARIATION WITHIN AND AMONG POPULATIONS

CONCLUSIONS

- Modern genetic and morphometric monitoring together with traditional tools are crucial in providing sound data for WCR control and these innovative techniques should be written into management practices for this species.







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THANK YOU FOR ATTENTION!!