

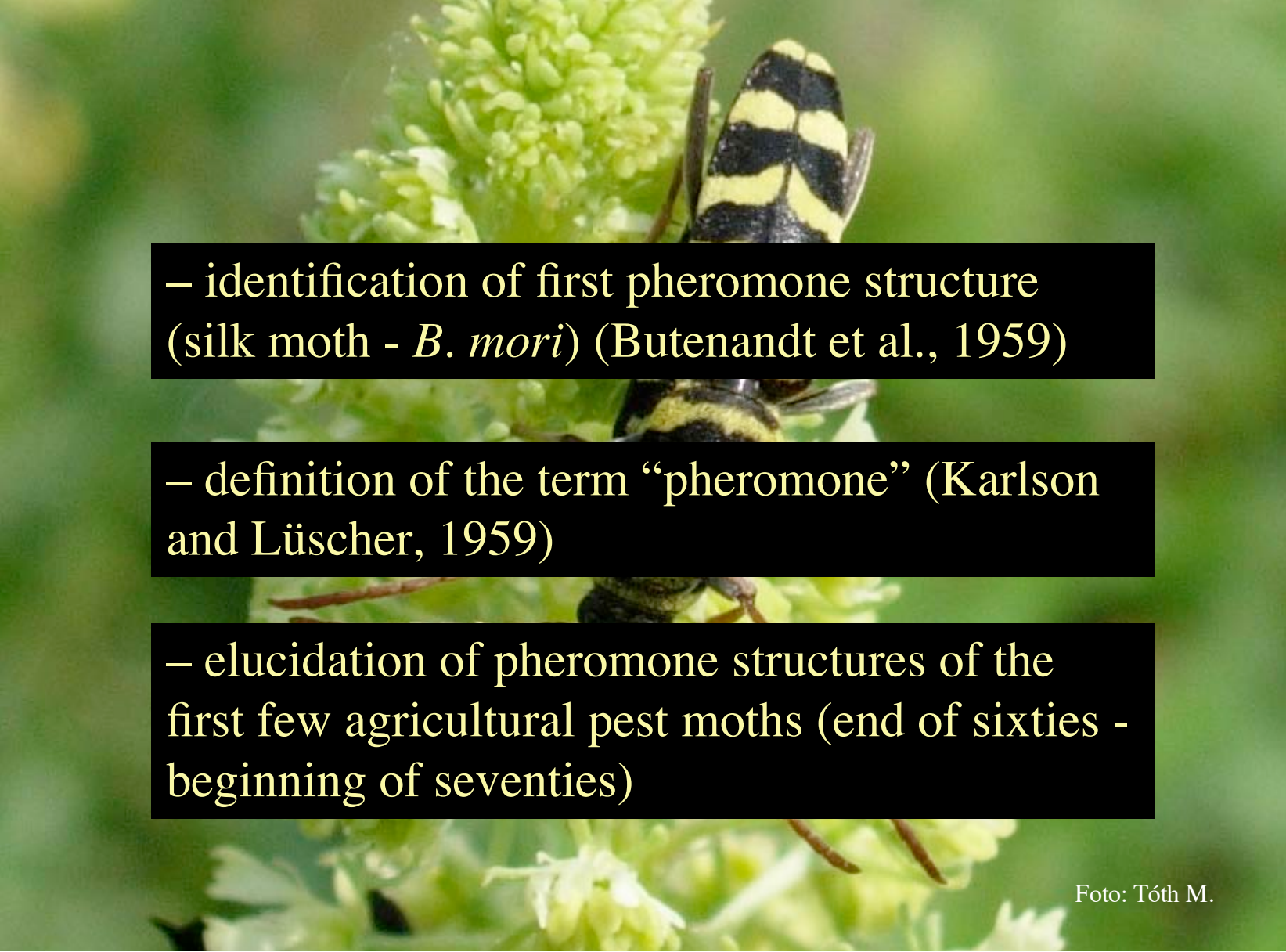
# Research on chemical ecology at the Plant Protection Institute (ATK HAS, Hungary)



Inaugural lecture, Hungarian  
Academy of Sciences  
Oct. 18, 2011.  
Miklós Tóth

Foto: Tóth M.

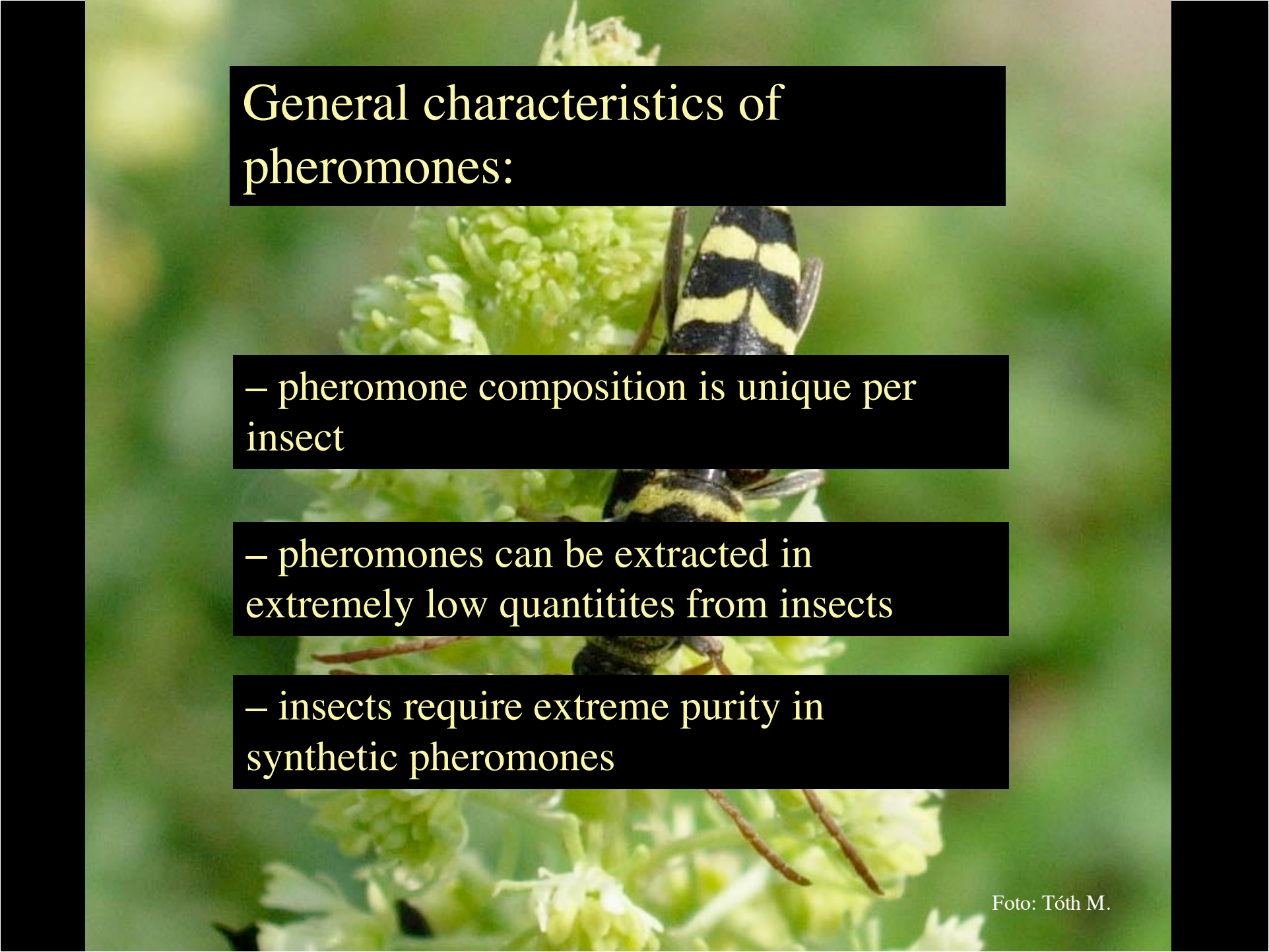
# Research and application of pheromones and other semiochemicals



– identification of first pheromone structure (silk moth - *B. mori*) (Butenandt et al., 1959)

– definition of the term “pheromone” (Karlson and Lüscher, 1959)

– elucidation of pheromone structures of the first few agricultural pest moths (end of sixties - beginning of seventies)



## General characteristics of pheromones:

- pheromone composition is unique per insect

- pheromones can be extracted in extremely low quantities from insects

- insects require extreme purity in synthetic pheromones

The challenge was:  
to elucidate pheromone composition of  
agricultural pest insects

Preconditions:

– as background, behavioral observations  
on target insects

– adaptation or development of special  
instruments and methods used in the  
research on pheromones

# Background studies: emission of pheromone - calling posture



Foto: Tóth M.

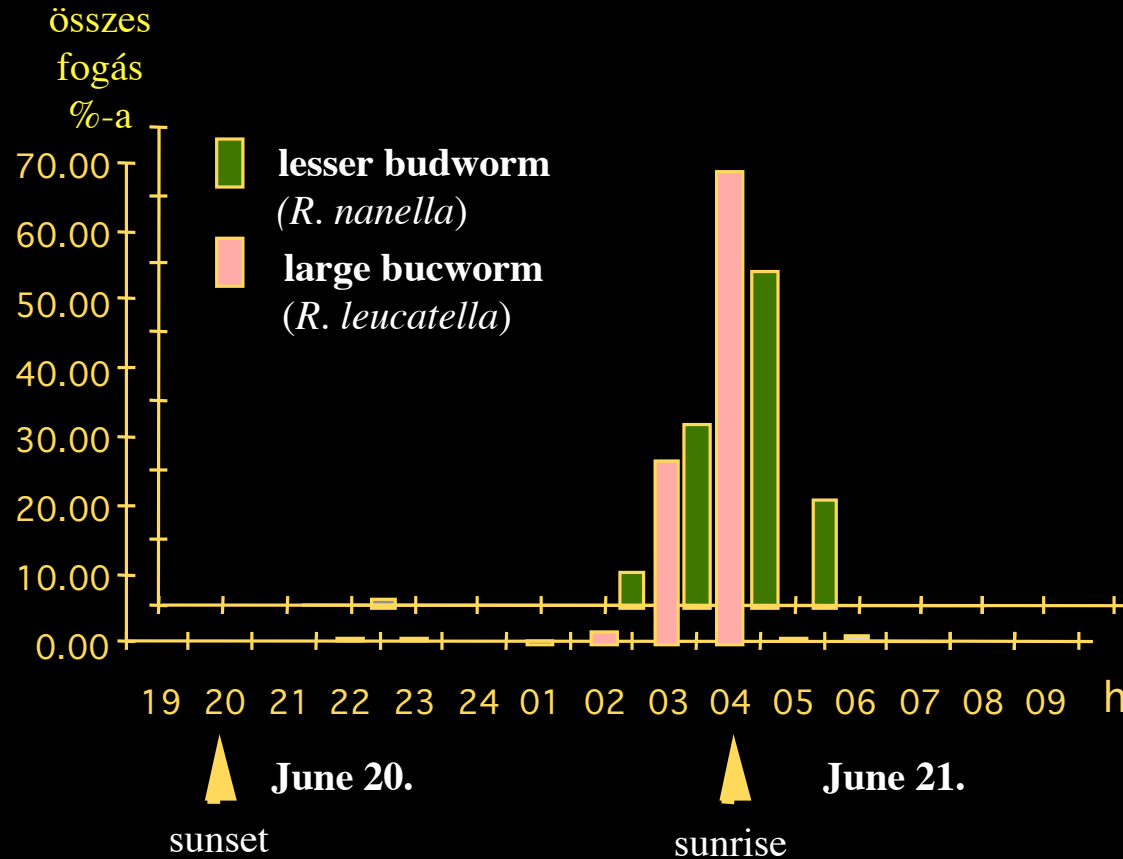
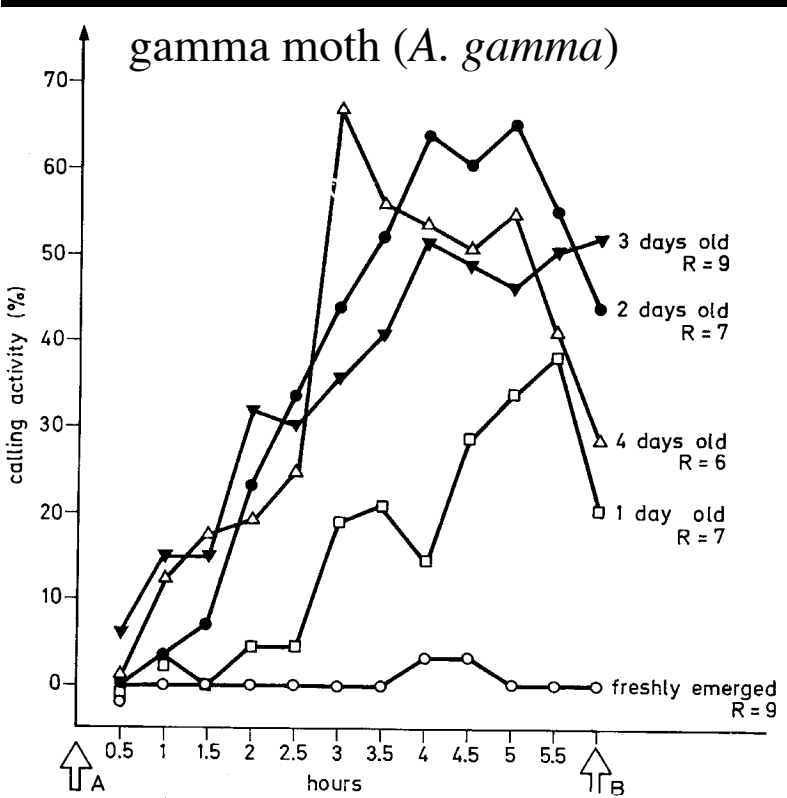


Foto: Szentesi Á.

cabbage armyworm  
(*M. brassicae*)

# Background studies: daily rhythmicity and age dependence of pheromone emission (females) and responsiveness (males) to the pheromone

## Intensity of calling behaviour



Catches (males) in traps baited with respective pheromone



# Adaptation / development of special instruments and methods: wind tunnel olfactometry

methods: wind tunnel olfactometry

Cabbage  
armyworm (*M.  
brassicae*)

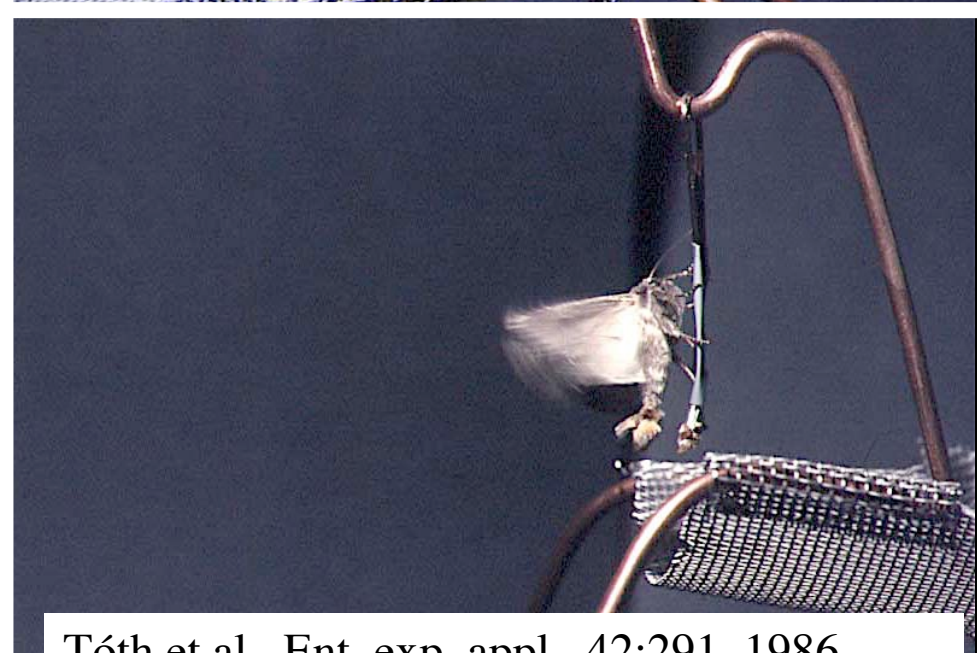
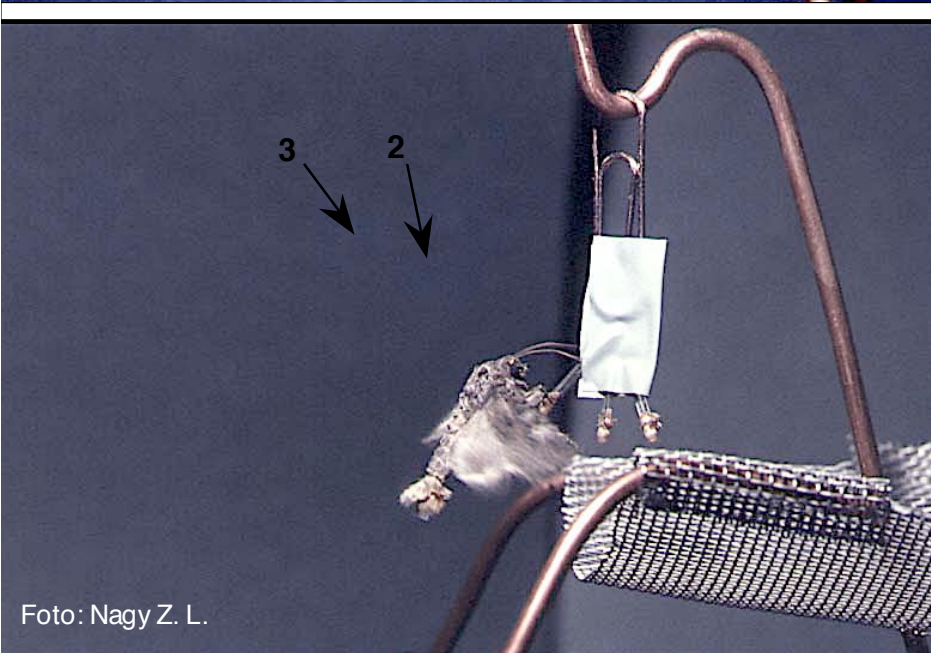
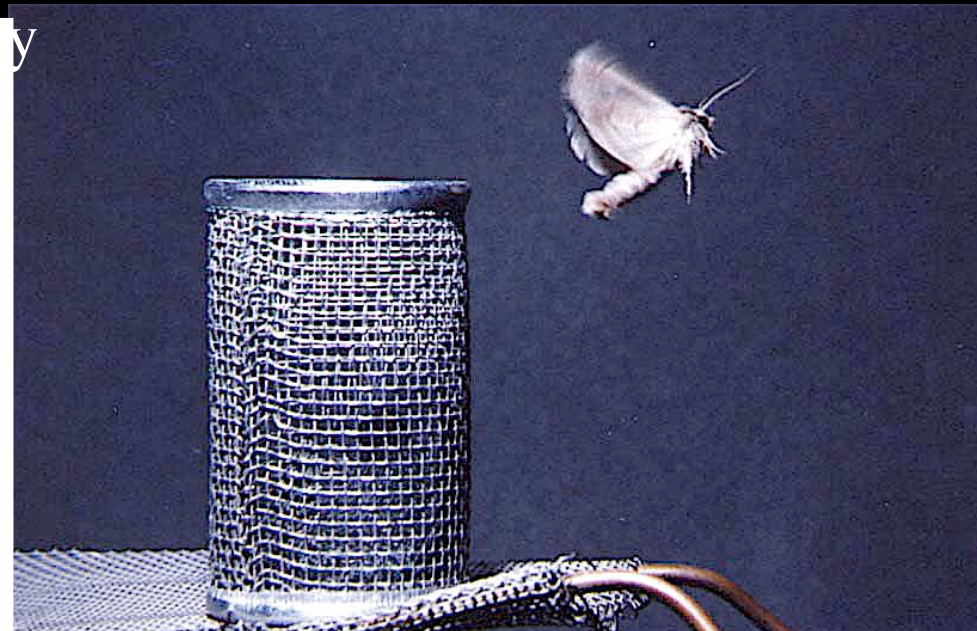
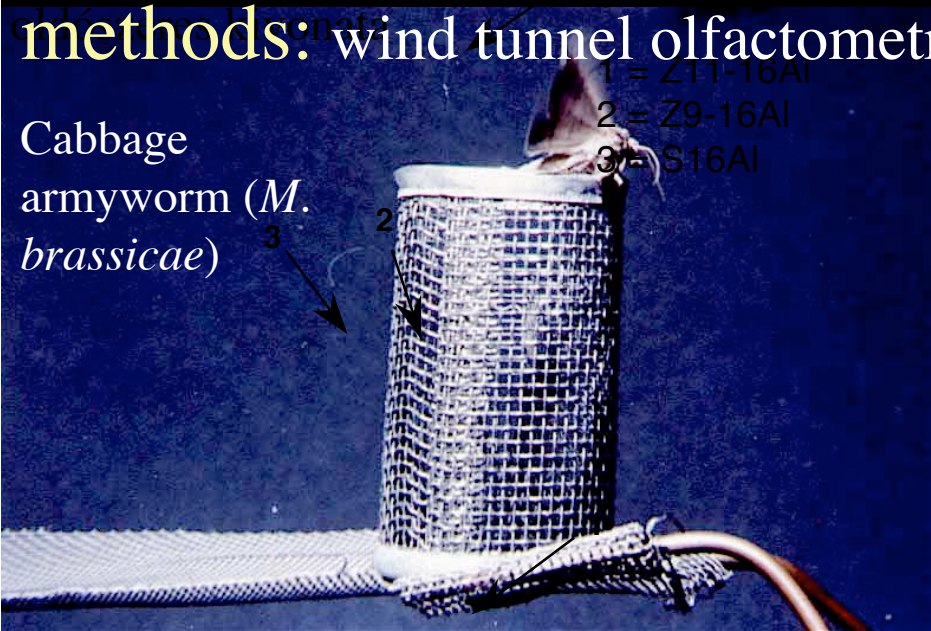
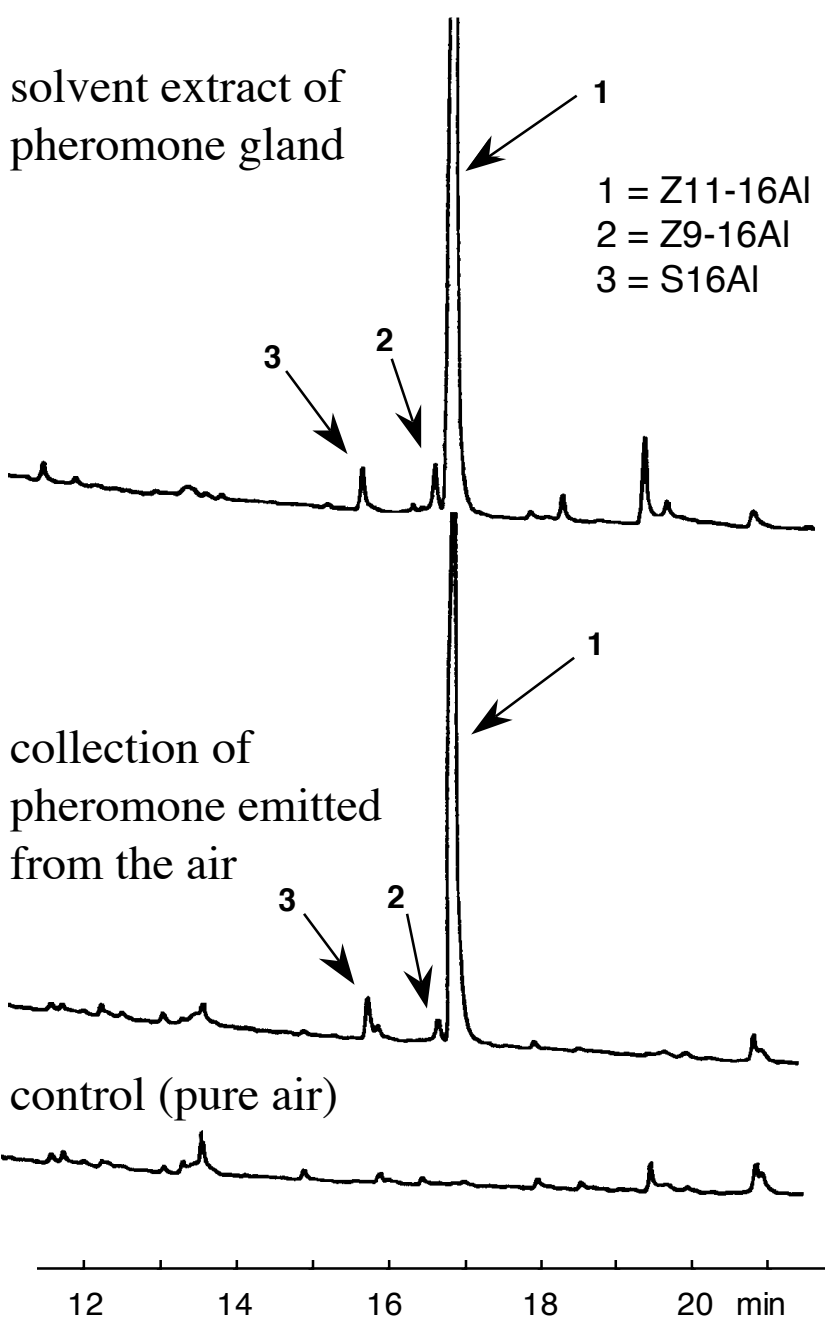


Foto: Nagy Z. L.

Tóth et al., Ent. exp. appl., 42:291, 1986

solvent extract of  
pheromone gland



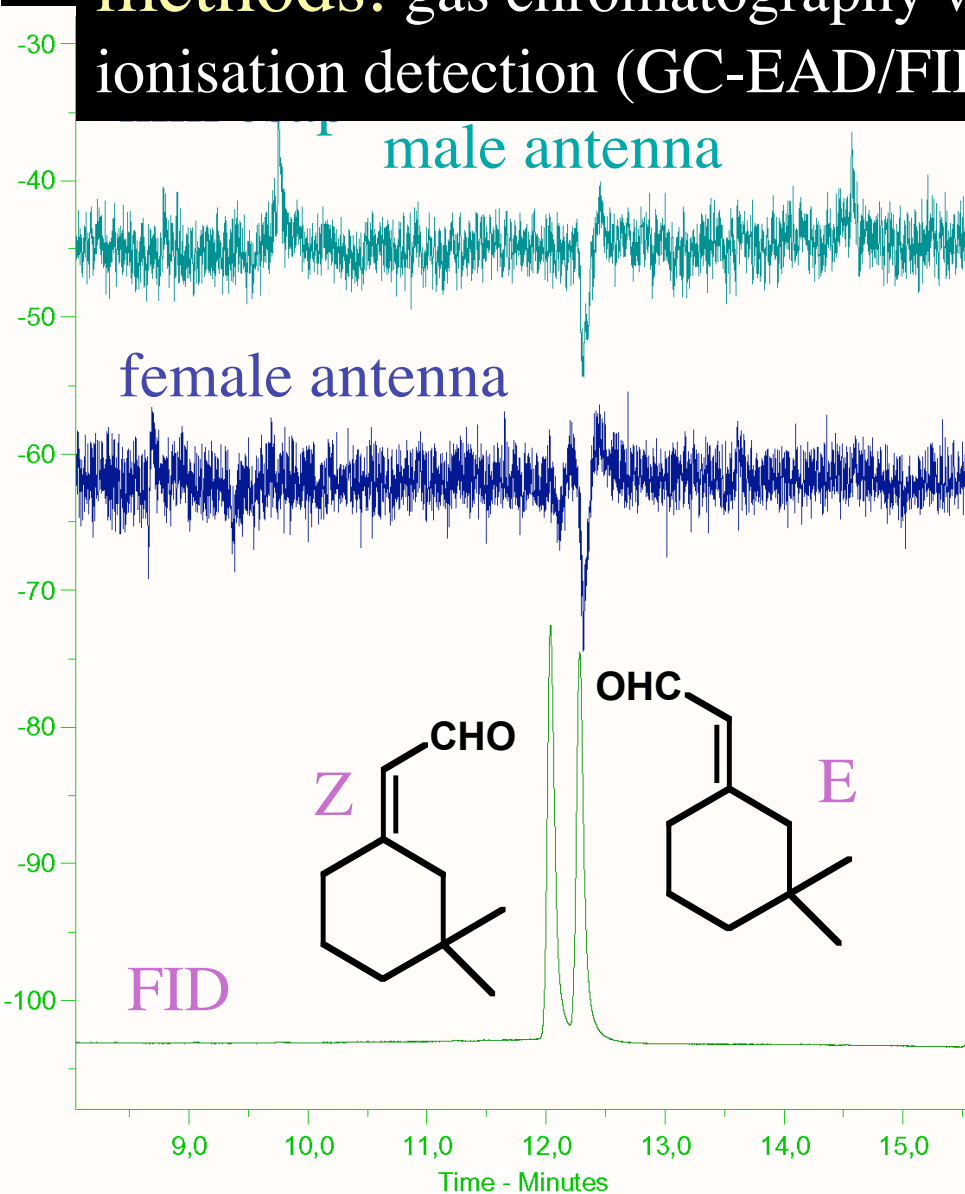
Tóth et al., J. Chromat., 598:303, 1992

Adaptation / development of  
special instruments and  
methods: volatile collection of  
pheromone in glass capillaries



Cotton bollworm (*H.  
armigera*)

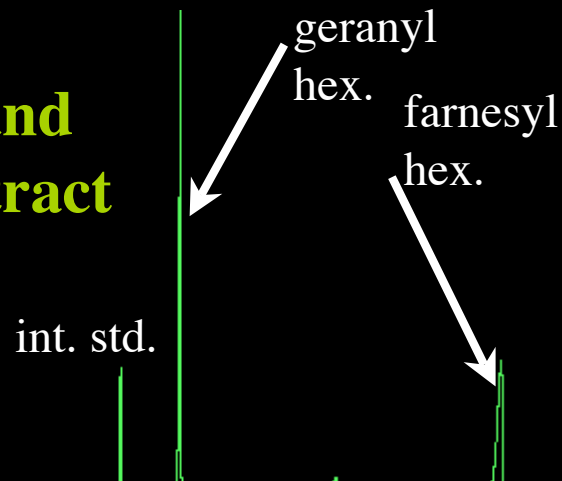
# Adaptation / development of special instruments and methods: gas chromatography with parallel insect antennal and flame ionisation detection (GC-EAD/FID)



# Adaptation / development of special instruments and methods: collection of volatiles in a closed-loop system (CLSA)

*Agriotes sordidus* click beetle

**gland  
extract**

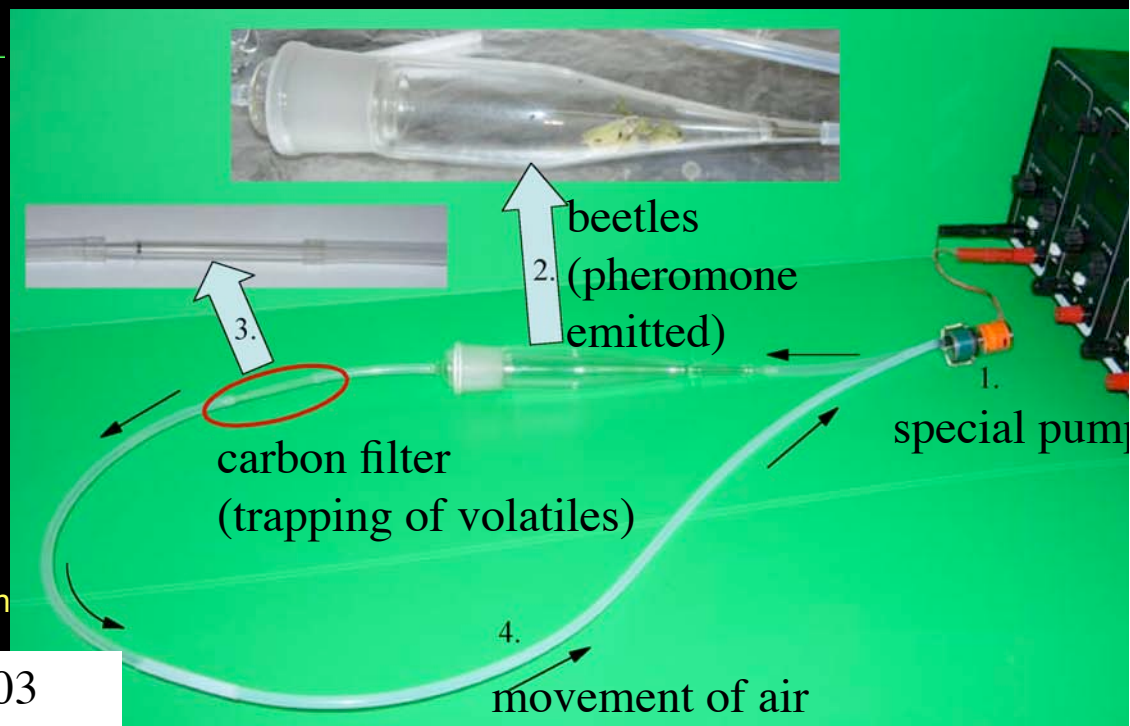
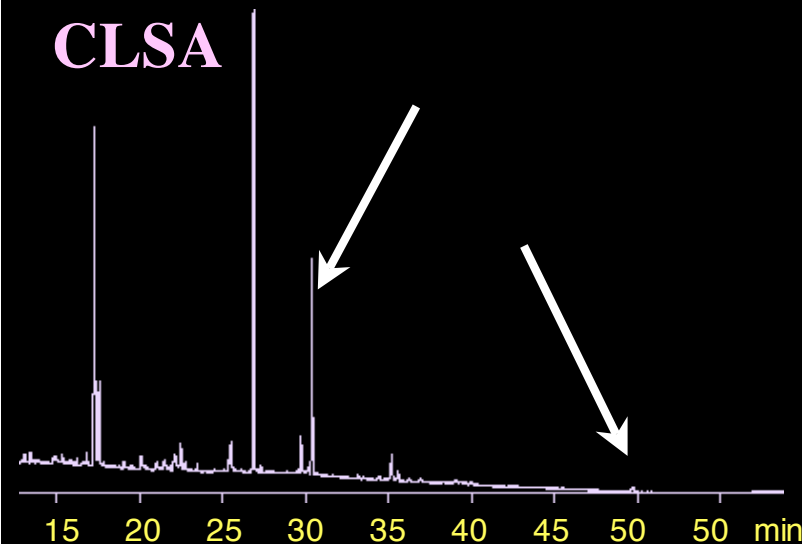


geranyl / farnesyl ratio

**mirigy:** 1 : 1

**CLSA** 1 : <0.1

**CLSA**

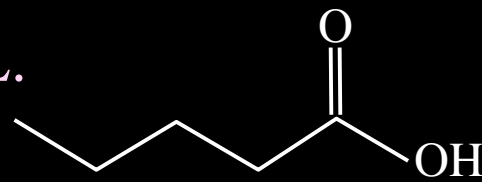


# Chemical research support:

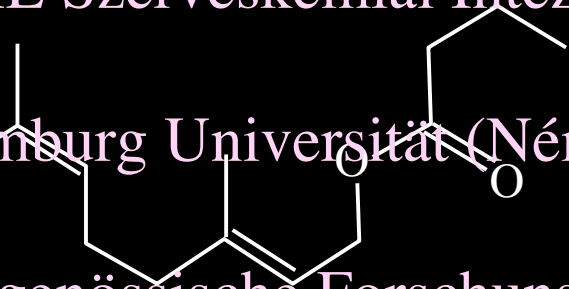
MTA Központi Kémiai Kutatóintézete - Szántay Cs.



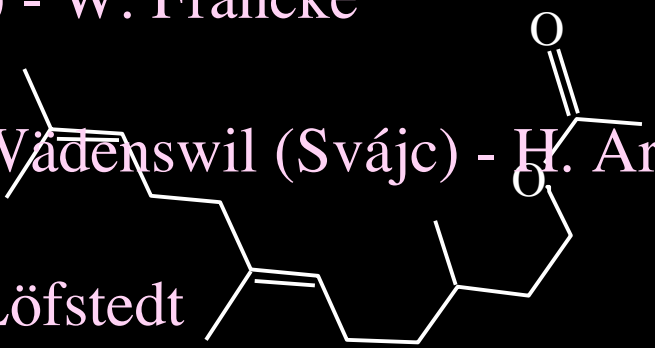
BME Szerveskémiai Intézet - Novák L.



Hamburg Universität (Németo.) - W. Francke



Eidgenössische Forschungsanstalt Wädenswil (Svájc) - H. Arn

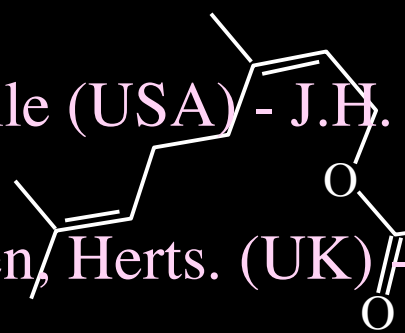


Lund University (Svédo.) - C. Löfstedt

USDA ARS NCUR, Peoria (USA) - R.E. Bartelt

USDA ARS CMAYE, Gainesville (USA) - J.H. Tumlinson

Rothamsted Research, Harpenden, Herts. (UK) - J.A. Pickett

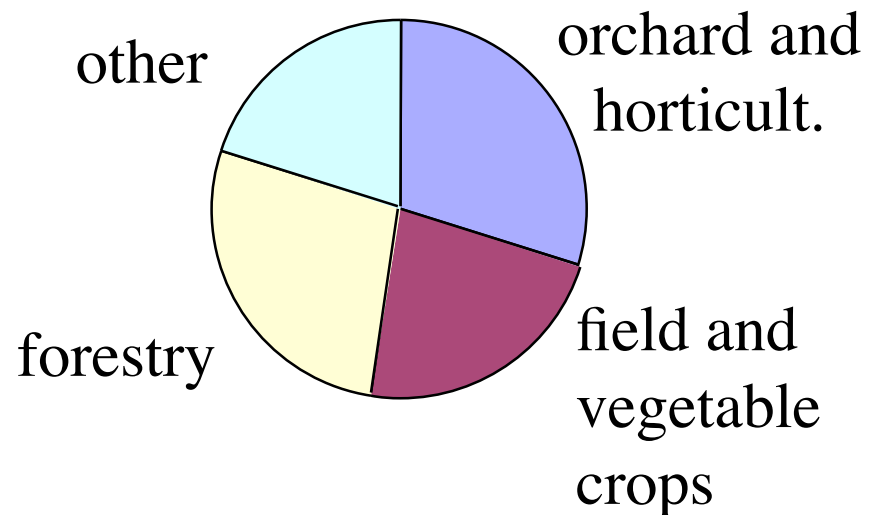


...and several other labs...

# New discoveries in moths (Lepidoptera)

Elucidation of chemical structures of  
pheromones in 47 pest moths

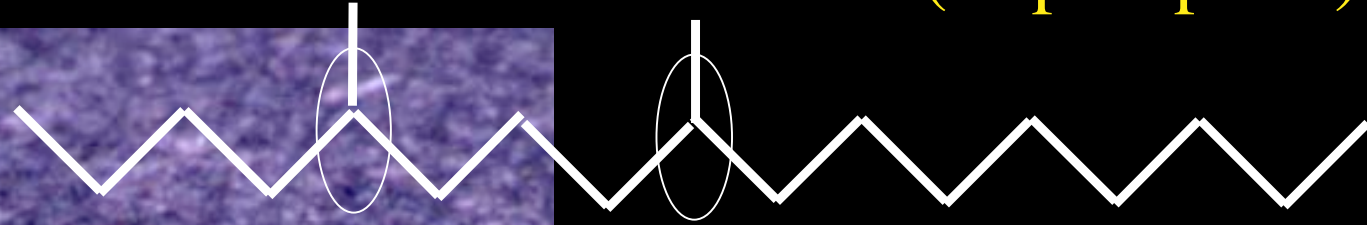
Distribution by plant culture:



# New discoveries in moths (Lepidoptera)

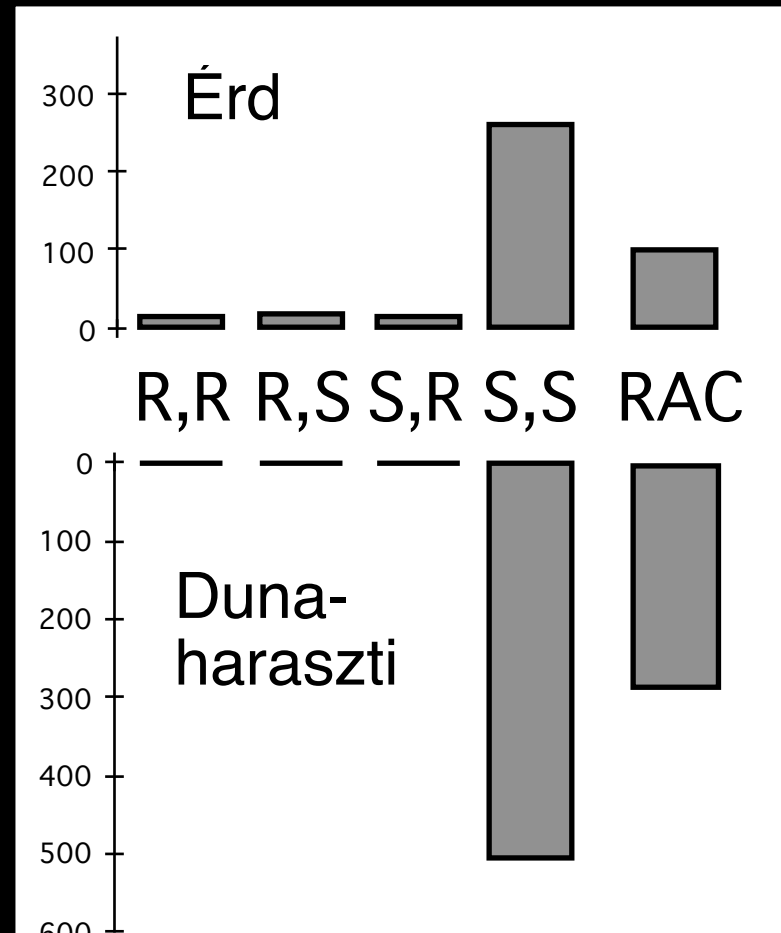


5,9-dimethyl-heptadecane



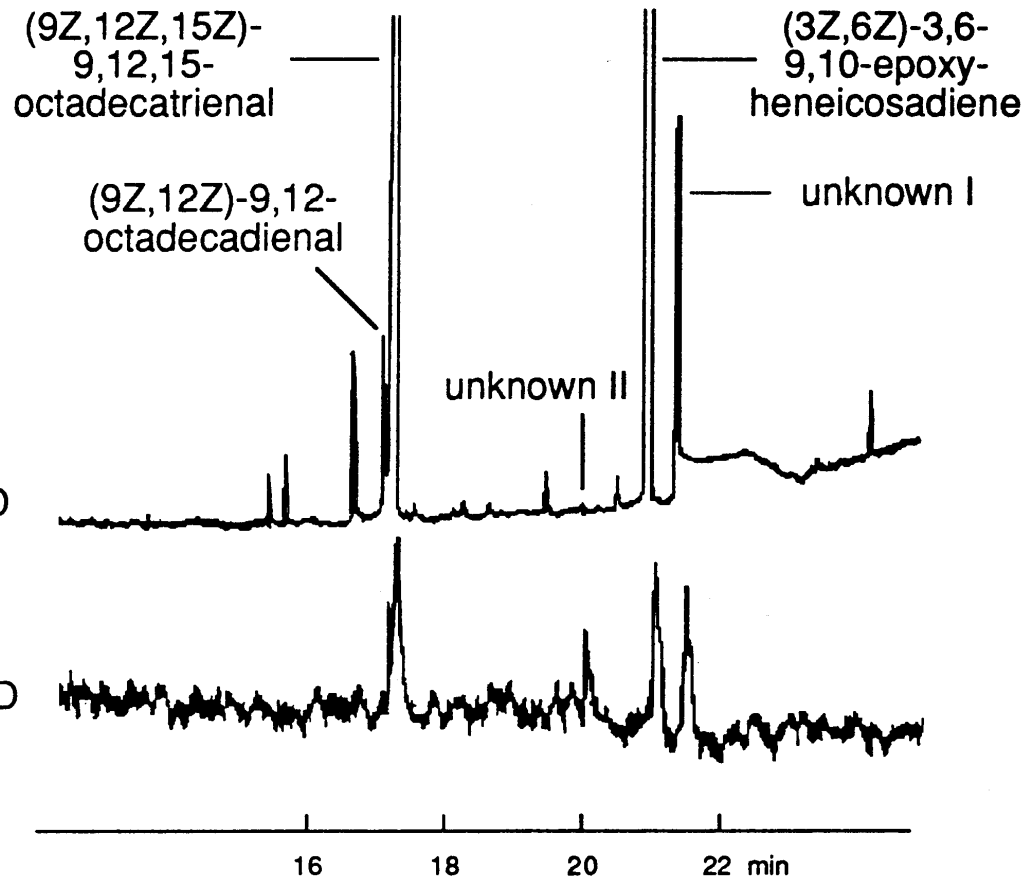
*Leucoptera scitella*

Foto: Nagy Z. L.



Tóth et al., J. Chem. Ecol. 15:1535, 1989

# New discoveries in moths (Lepidoptera)



(3Z,6Z)-1,3,6-9S,10R-epoxy heneicosatriene



fall webworm  
(*H. cunea*)



Foto: Nagy Z. L.



Tóth et al., Tetrahedron Lett. 30:3405, 1989

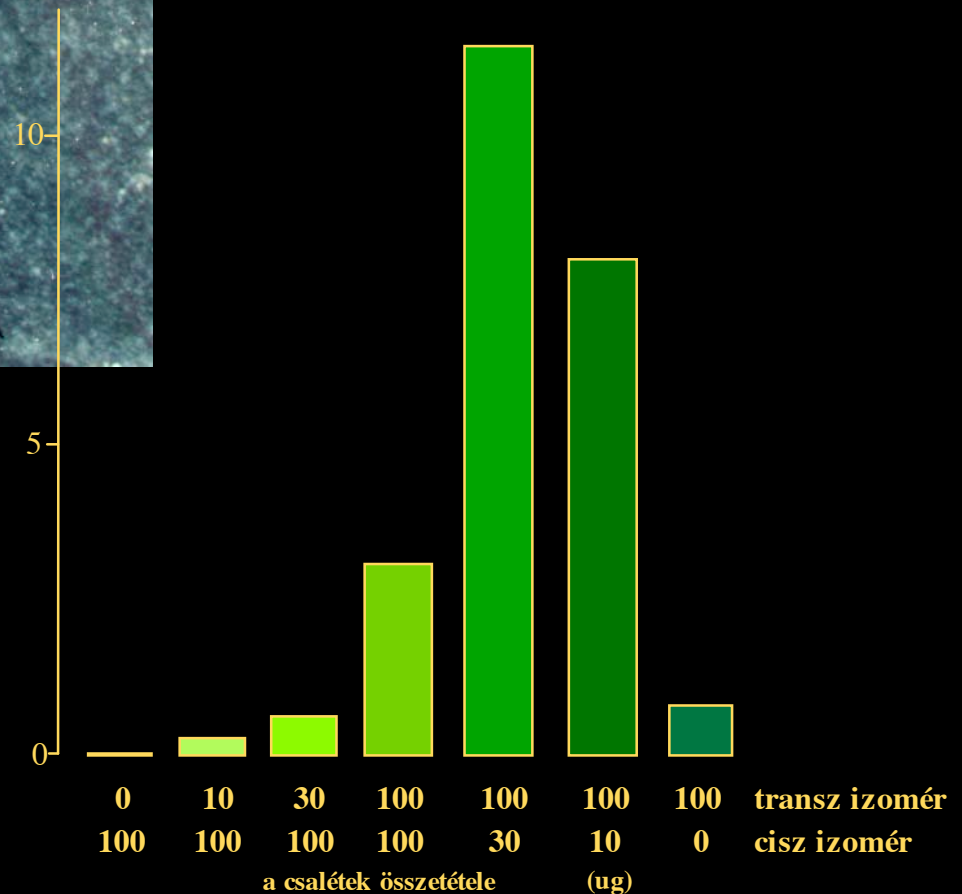
# New discoveries in moths (Lepidoptera)

*Nepticula malella*

Foto: Nagy Z. L.



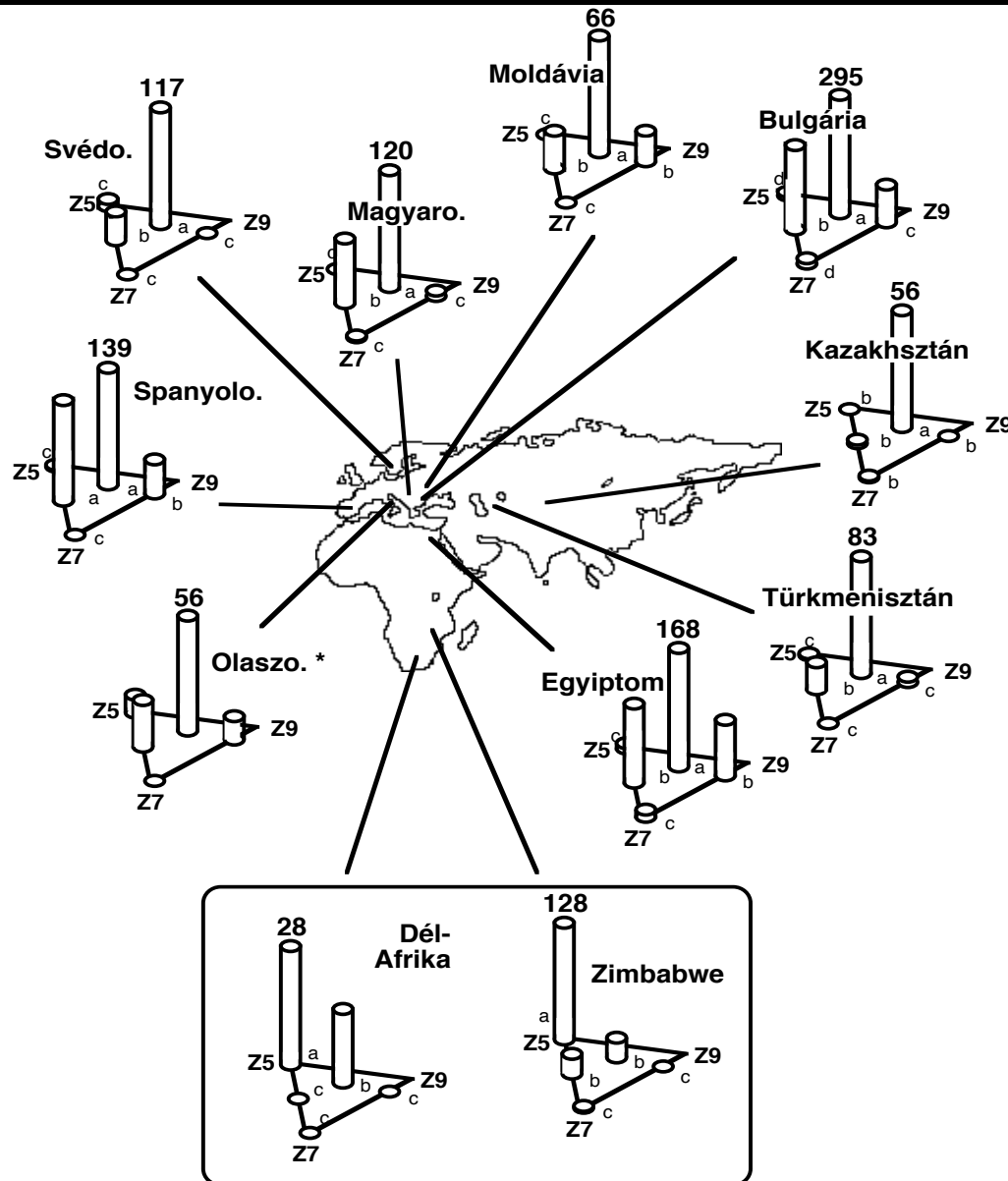
6,8-nonadiene-2-ol



Tóth et al., J. Chem. Ecol. 21:13, 1995

# New discoveries in moths (Lepidoptera)

Turnip moth (*A. segetum*):  
pheromonal “strains”



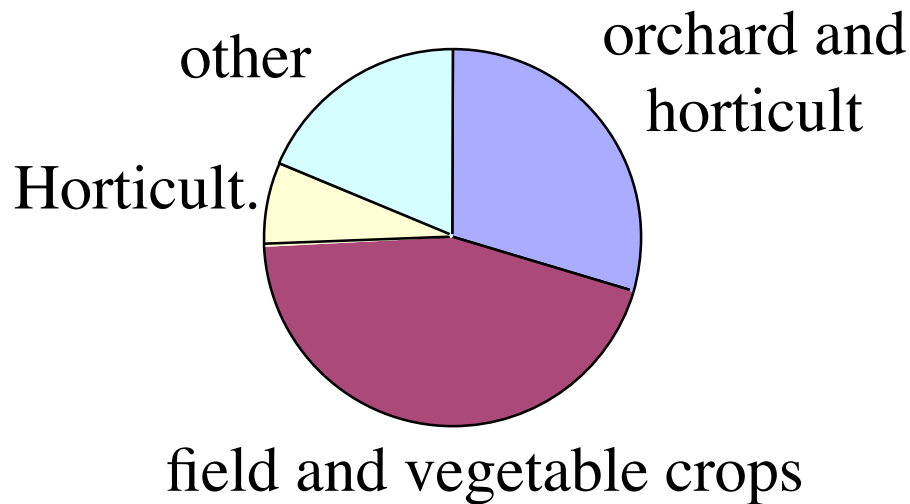
Tóth et al., J. Chem. Ecol. 18:1337, 1992



# New discoveries in beetles (Coleoptera)

Identification of pheromones, allomones and kairomones in 25 pest beetles

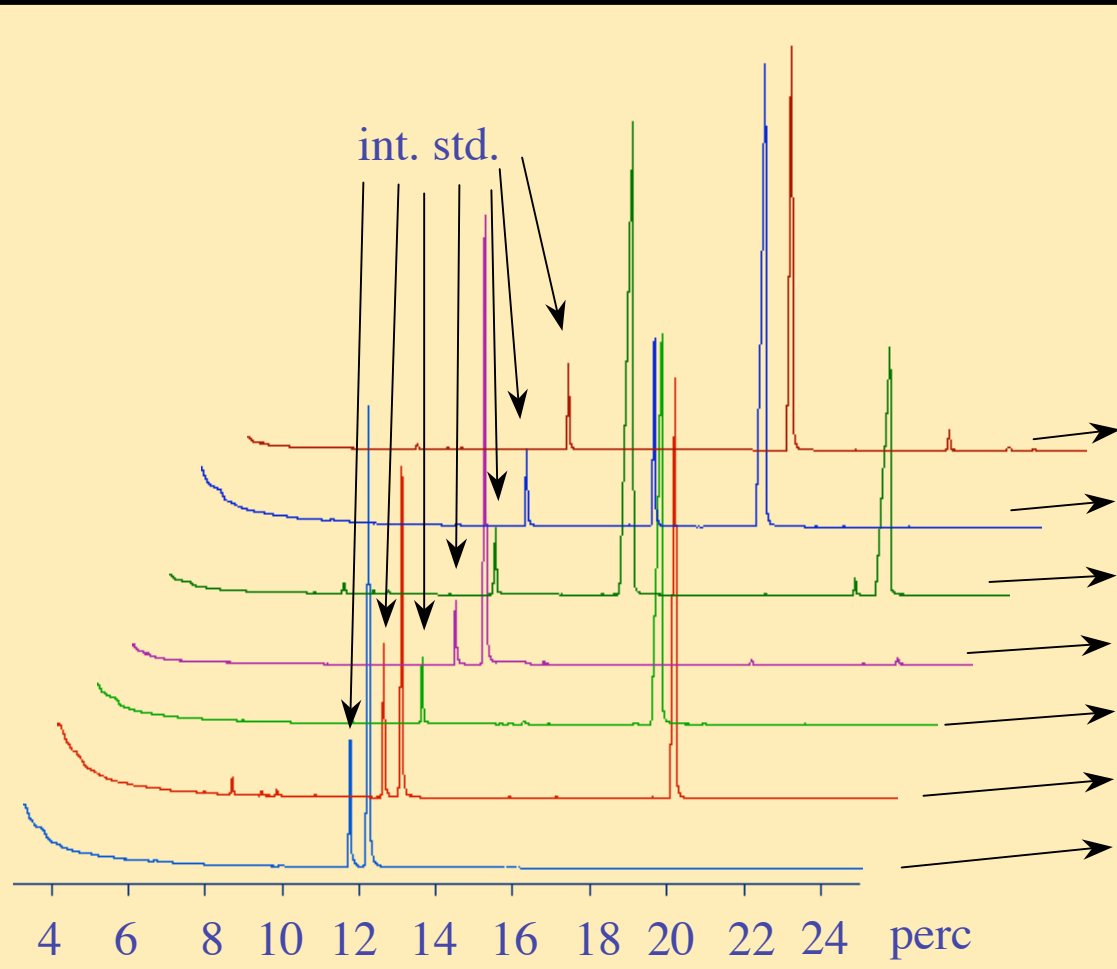
Distribution by plant culture



# New discoveries in beetles (Coleoptera)

## Click beetles (Elateridae)

Gas chromatography of pheromone gland extracts



- first identification
- improving known composition
- confirming known composition

- *A. ustulatus*
- *A. obscurus*
- *A. sordidus*
- *A. litigiosus*
- *A. lineatus*
- *A. brevis*
- *A. sputator*
- *A. rufipalpis*
- *A. proximus*

# New discoveries in beetles (Coleoptera)

## Scarab beetles(Scarabaeidae)

● first  
identification

● improving known  
composition

● confirming known  
composition



Foto Tóth M.

Foto I. Sivcev

● *A. dubia*

● *A. solida*

● *A. solstitialis*

● *A. vitis*

● *C. aurata*

● *E. hirta*

● *O. funesta*

● *O. cinctella*

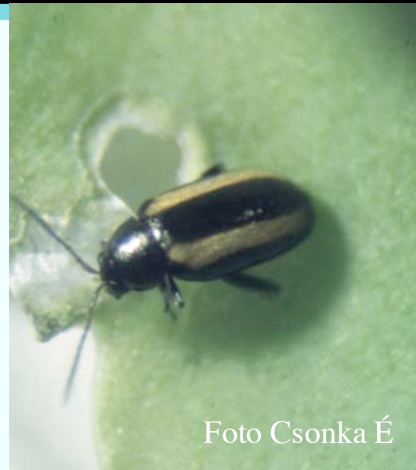
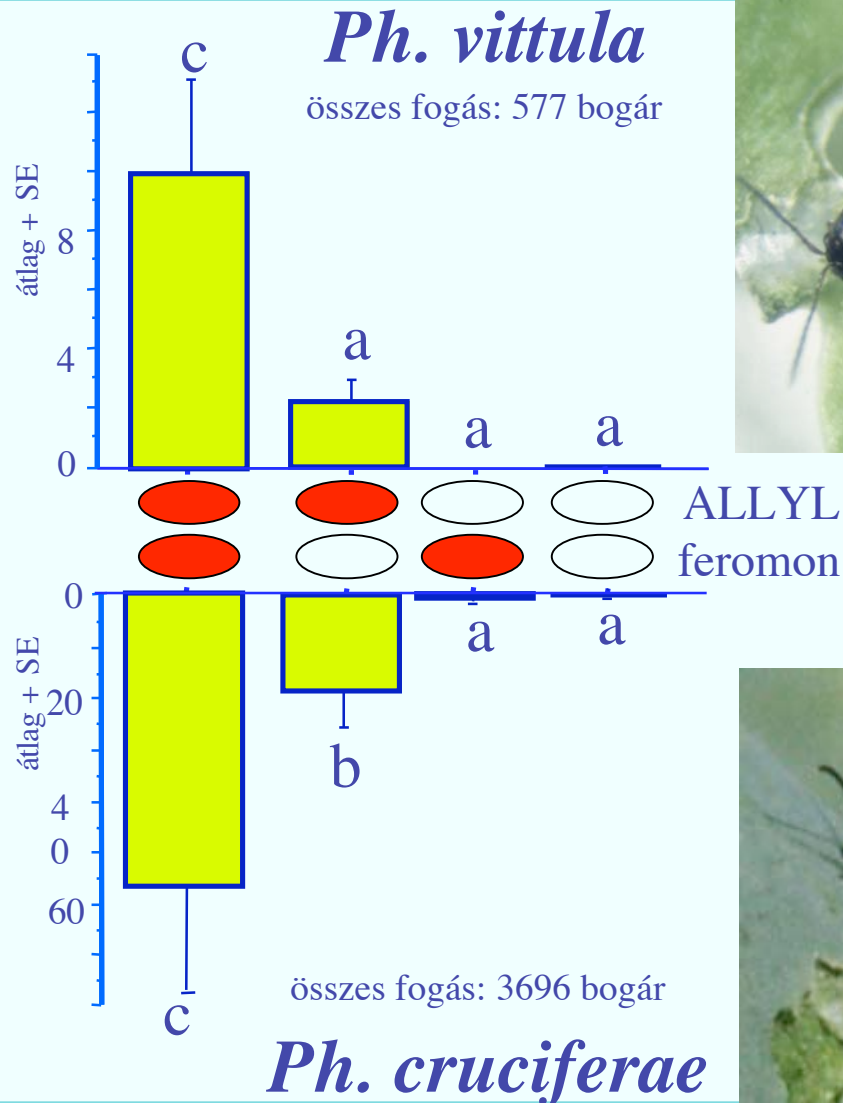
● *P. cuprea*

● *R. vernus*

● *T. squalida*

# New discoveries in beetles (Coleoptera)

## Flea beetles (Halticidae)



first  
identification

improving known  
composition

confirming known  
composition

*Ph. cruciferae*  
(európai populáció)

*Ph. nemorum*

*Ph. nigripes*

*Ph. undulata*

*Ph. vittula*

# Extension activities

Application of our scientific results:

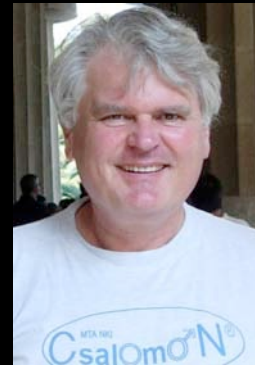
non-profit advisory extension service for detection, monitoring and forecast

+

pest-specific pheromone trap



The “founding fathers”:



Tóth Miklós



Szőcs Gábor



Ujváry István



Extensive field tests before traps for a given pest are put on our product list available to farmers



Among traps developed by us one of the most successful ones is the **CSALOMON® PAL**

pheromone trap, which is the supported trap type for detection and monitoring of *Diabrotica v. virgifera* in EU countries [EU framework 5 (QLK5-CT-1999-01110)].



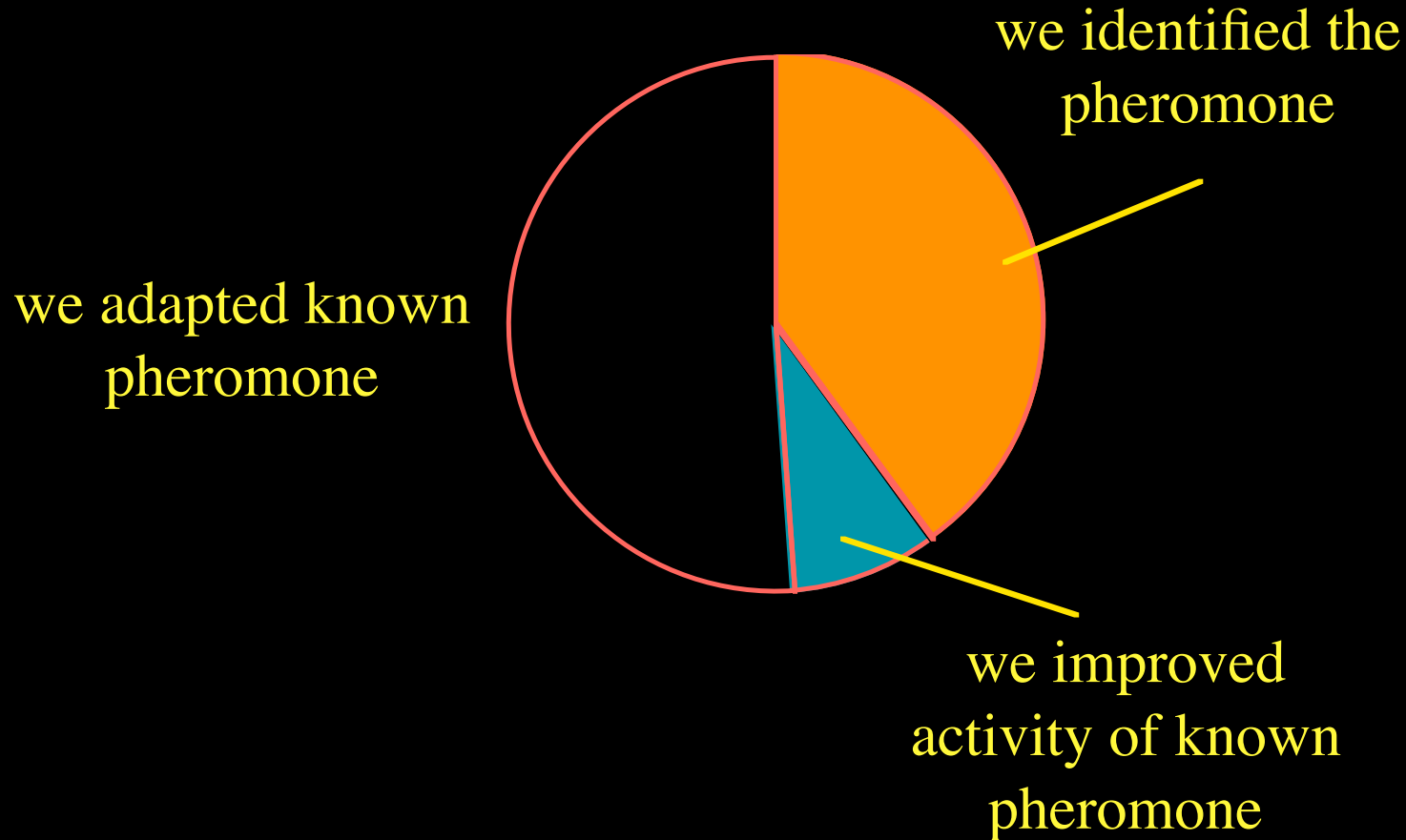
Occurrence of  
*Diabrotica v.*  
*virgifera* in  
Europe  
in 2010

From 1995 on  
detected by  
CSALOMON®  
PAL pheromone  
traps

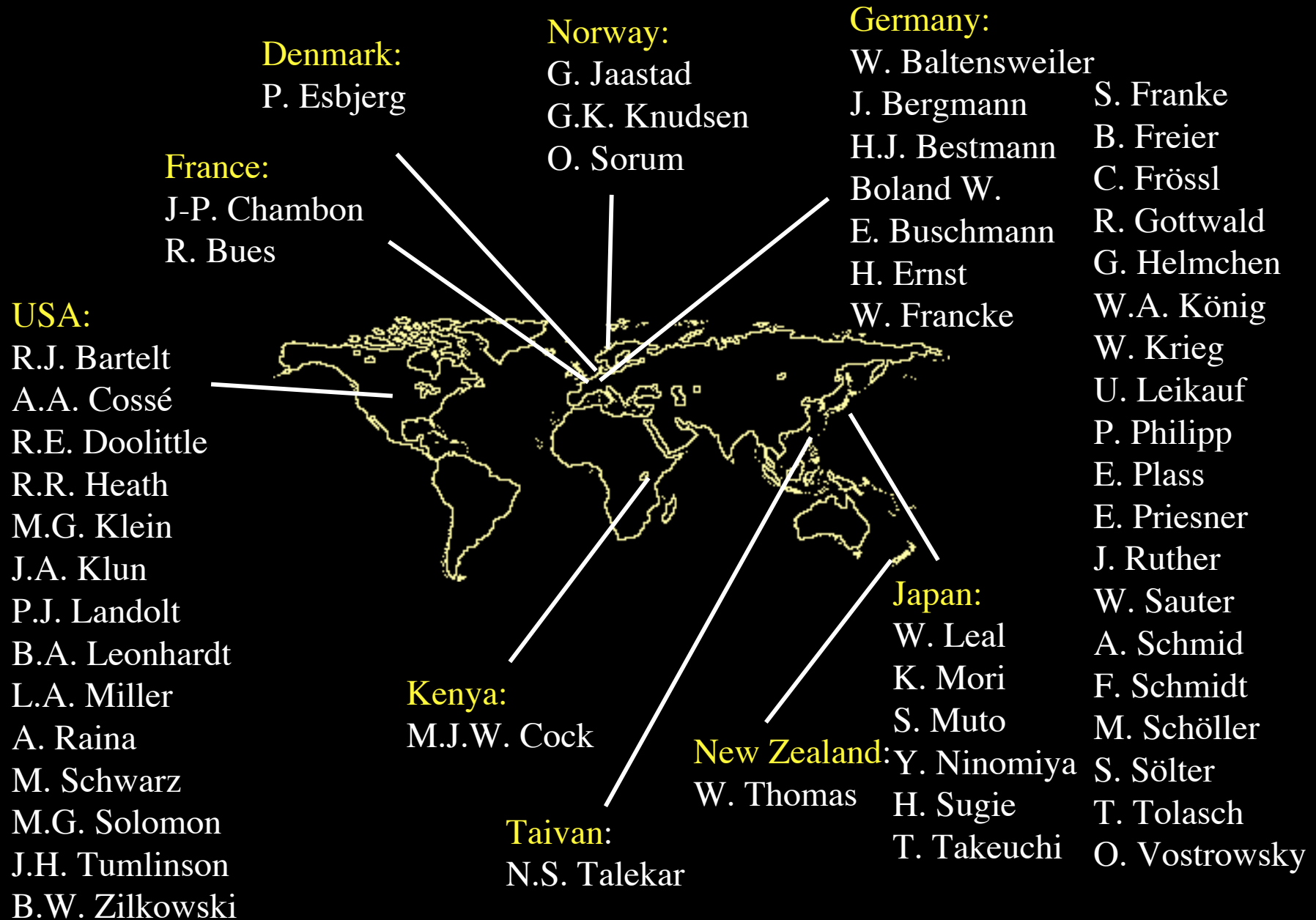


# Contribution of basic scientific research to the CSALOMON<sup>®</sup> trap family:

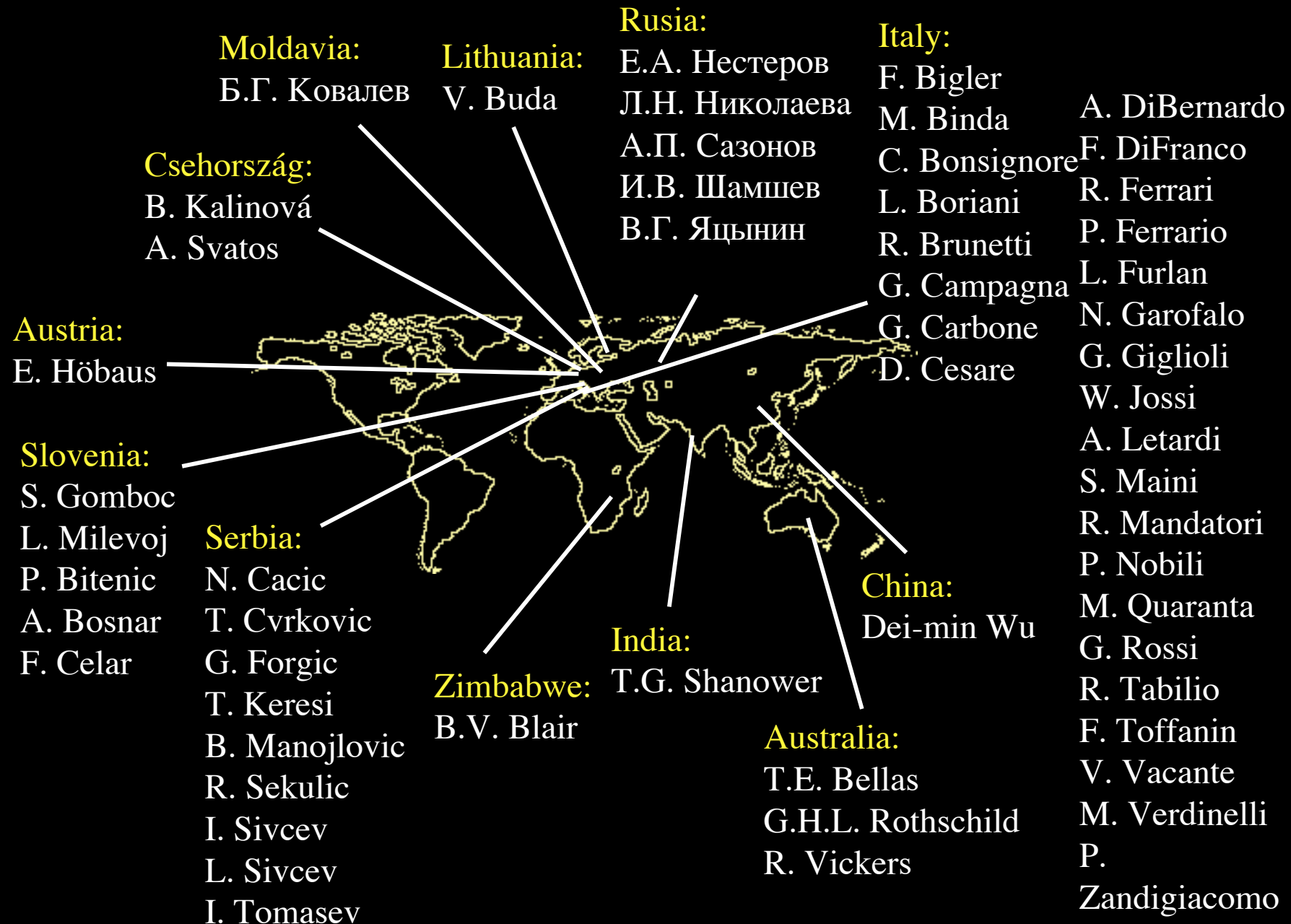
From all species on our list of products:



# Acknowledgements: my coauthors (and their “geographical occurrence”)



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