



JKI

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Federal Research Centre for Cultivated Plants

Stir Bar Sorptive Extraction – A method for detection of volatiles from potato plants?

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1 Background

BMBF project : Methods for a case-specific GMO monitoring in Europe

Part 8.2: Deduction of case-specific monitoring parameters for transgenic potato and cereals

→ **study of literature on secondary plant metabolites**

Risk assessment of transgenic plants

- ecological aspects:
 - impact on non-target organisms
 - plant health and sustainability

Suitability of secondary plant metabolites as parameters?

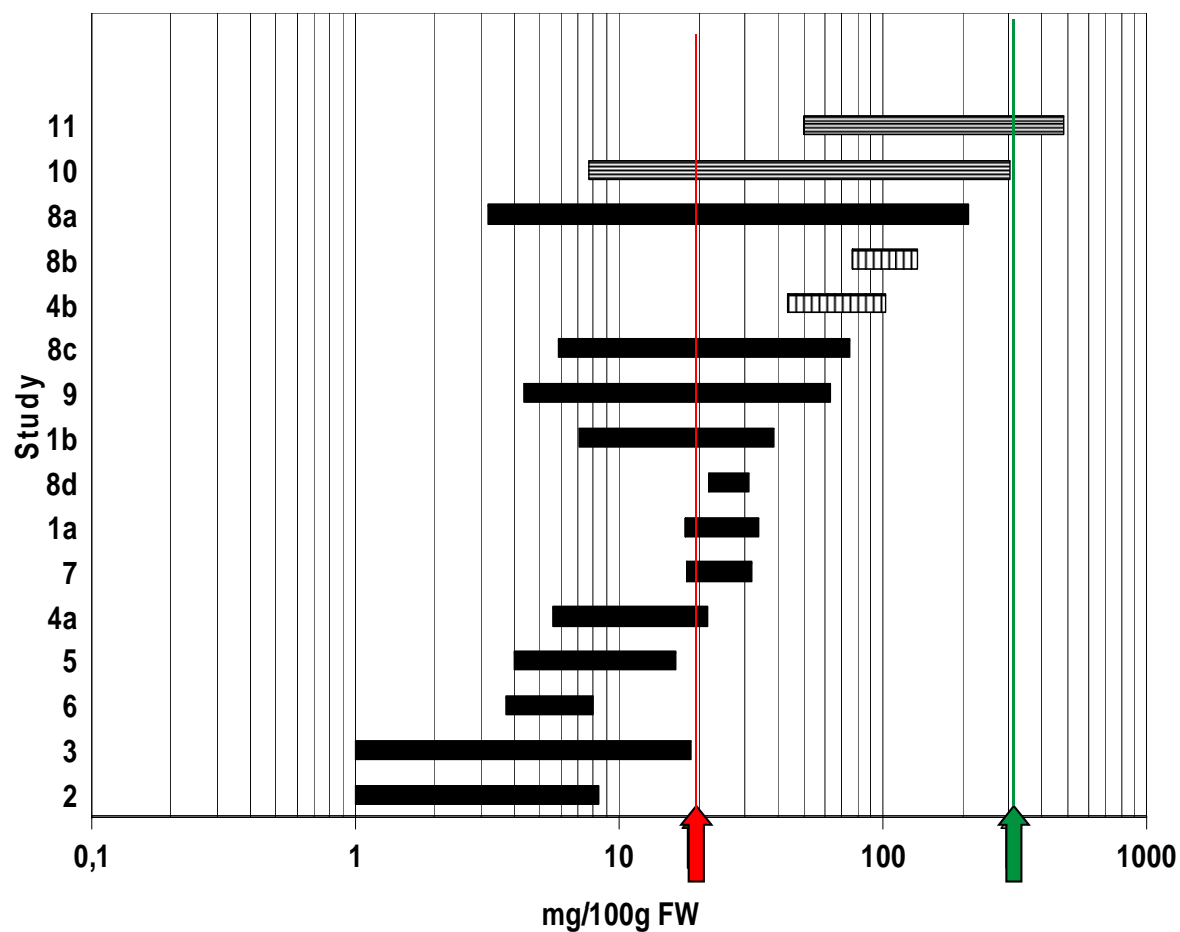
→ ecological functions

- toxin for herbivores
- attraction of insects

→ precondition

- knowledge about the function (causal relationship)
- range of values
- relevance for agriculture

Total glycoalkaloid content



Toxicity to humans

50% feeding reduction of Colorado potato beetle

Paper: Ziegler, A., Wilhelm, R. (2010) IOBC/wprs Bulletin 52;111-115

Volatile plant metabolites

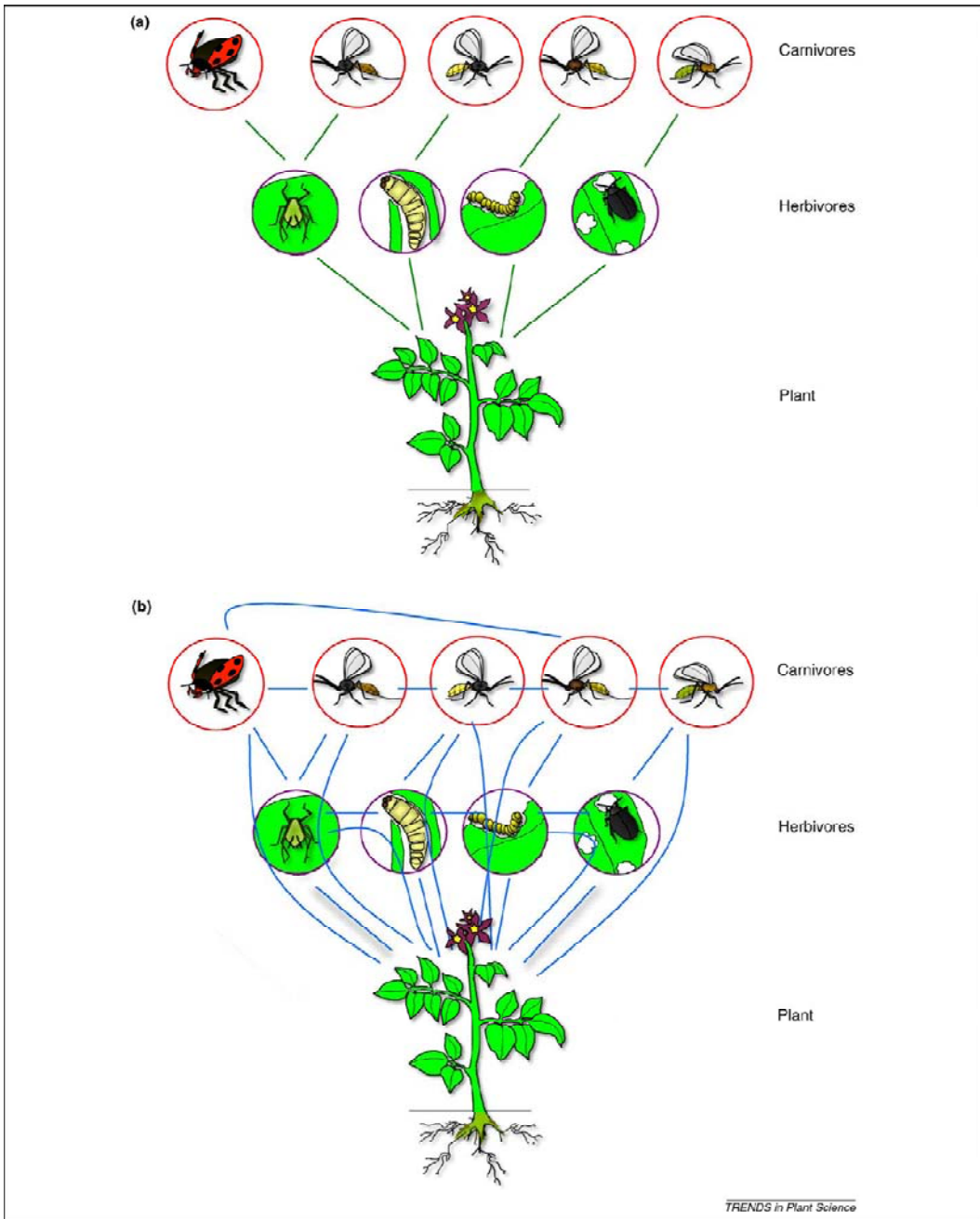
→ spectrum of organic substances:

- Synthesis from fatty acids = C6 hydrocarbons („green leaf volatiles“)
- Isoprenoid pathway = Terpenoids (Monoterpenes, Sesquiterpenes)
- Synthesis from amino acids = Phenylpropane, Glucosinolates...

→ Function of terpenoids: Semiochemicals

→ Emission:

- constitutive
- induced
 - biotic: pathogenes, pests
 - abiotic: air pollution, drought



Dicke, M. (2010): The evolutionary context for herbivore-induced plant volatiles: beyond the 'cry for help'

2 Stir Bar Sorptive Extraction (SBSE)

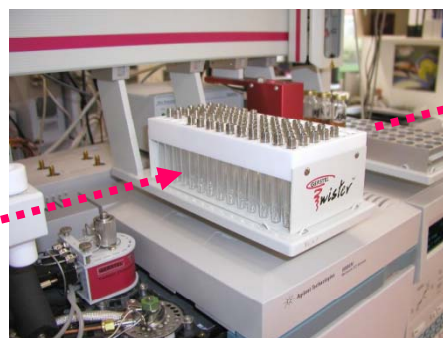
- Innovative, fast and solvent-free sample preparation method for GC and GC/MS
- Extraction of volatile compounds in aqueous and gaseous samples
- Suitable for field sampling
- Suitable for trace analysis
- Principle: partitioning equilibrium between PDMS- phase and sample volume → result depends on physical properties of the compounds

Stir Bar Sorptive Extraction (SBSE) - "Twister"

Working group „Aromatic and signal compounds“, JKI



MPS – multi purpose sampler



TDU – thermo desorption unit

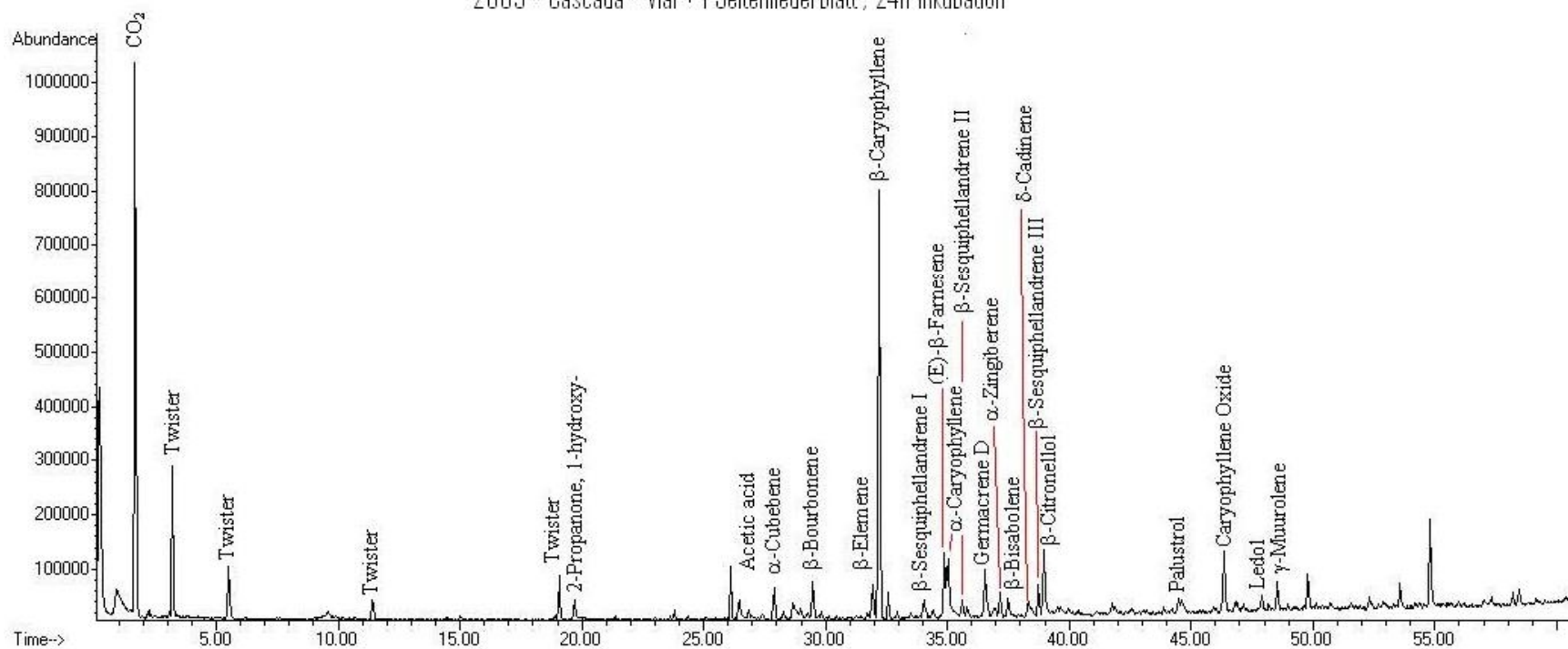


CIS – cold injection system

„Twister“ is a trade mark of Gerstel GmbH, Mühlheim/R., Germany

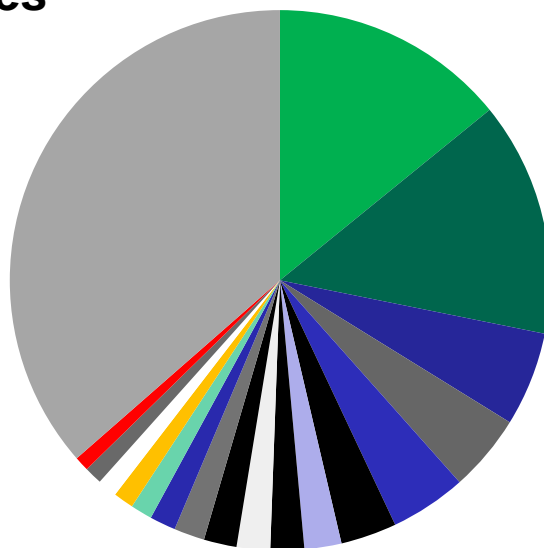
Chromatogram of potato variety Cascada

2009 - Cascada - Vial + 1 Seitenfiederblatt ; 24h Inkubation

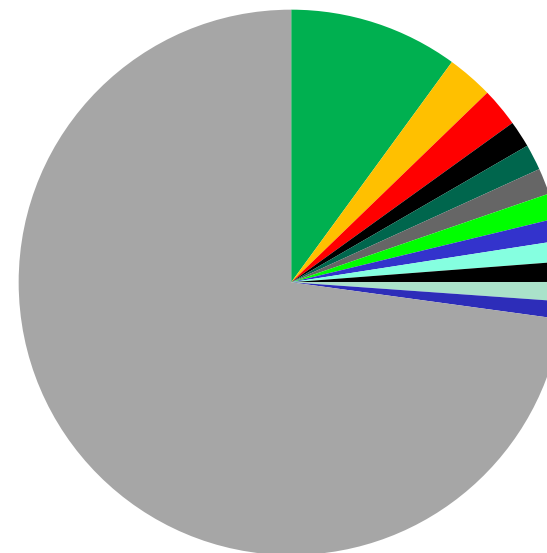


Terpenoids of potato leaves (% of total volatiles)

Hermes



Cascada



■ β -Caryophyllene

■ γ -Muurolene

■ β -Elemene

■ γ -Elemene

■ Ledol

■ Camphor

■ β -Sesquiphellandrene I

■ α -Gurjunene

■ E- β -Farnesene

■ Germacrene D

■ d-Cadinene

■ β -Sesquiphellandrene III

■ α -Zingiberene

■ β -Sesquiphellandrene II

■ β -Bisabolene

■ α -Caryophyllene

■ Eucalyptol

■ Rest

■ β -Caryophyllene

■ α -Caryophyllene

■ E- β -Farnesene

■ α -Zingiberene

■ Germacrene D

■ d-Cadinene

■ β -Citronellol

■ γ -Muurolene

■ Caryophyllene oxide

■ β -Sesquiphellandrene III

■ α -Cubebene



3 Project

intention:

method for a reproducible description of the spectrum of volatile compounds of potato varieties

Part 1: methodical test and determination of sources for errors

Questions / test parameters:

- plant cultivation (reproducibility)
- jars/ vessels for extraction (pooled samples)
- „Twister“ as a source of error
- duration of extraction (flexibility)
- storage of loaded „Twister“ (flexibility)
- age of plants and leaves (biological variability)
- interpretation of data

Part 2: identification of volatile spectra of selected potato varieties

- selection of potato varieties from the German federal list of varieties
criteria: susceptibility to viruses and nematodes

Future work:

- field tests and analysis of environmental impacts



Thank you for your attention!

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