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

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Young Scientists Meeting 2010
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

Study

mg/100g FW

Toxicity to humans  50% feeding reduction of Colorado potato beetle

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 \(\Rightarrow\) 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
Terpenoids of potato leaves (% of total volatiles)

Hermes
- 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
- Caryophyllene oxide

Cascada
- 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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