BEYOND THE SMELL

Evaluation of wireworm potato varietal preference associated with tuber volatile emissions, palatability, and larval fitness

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GHENT UNIVERSITY
ISCP INTERNATIONAL SYMPOSIUM ON CROP PROTECTION

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Wireworms

Coleoptera: Elateridae

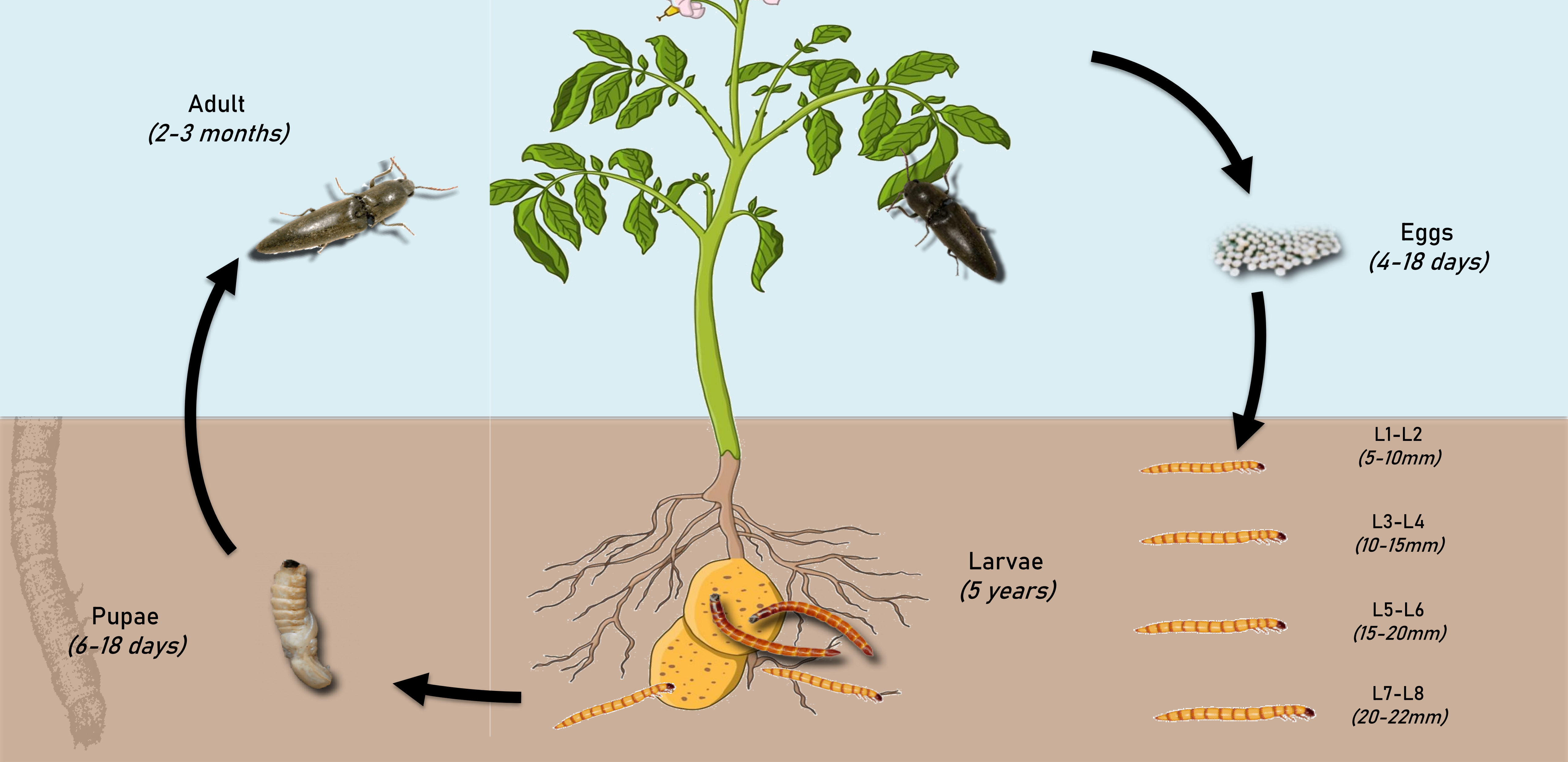
Larvae

Adult

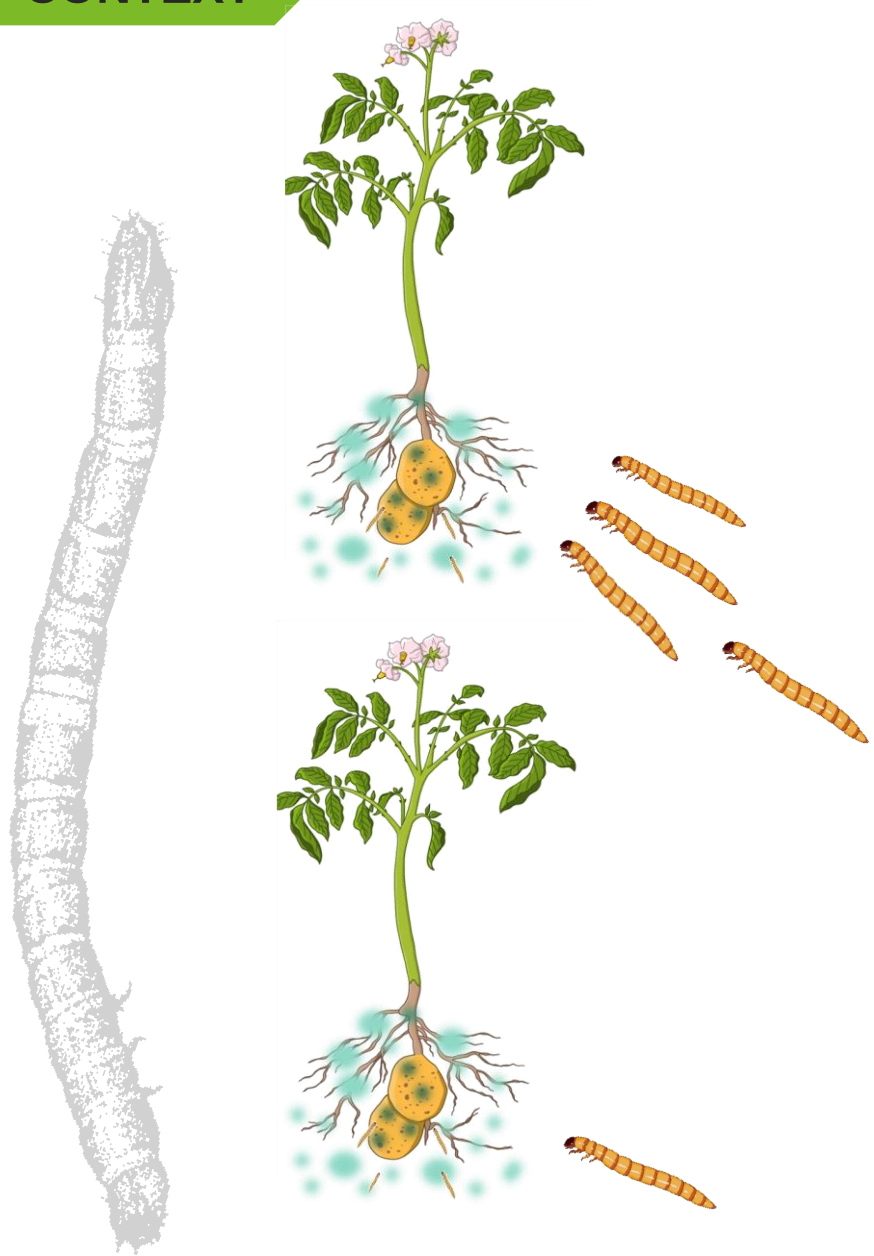
Chemical

- Organophosphates
- Pyrethroids
- Neonicotinoids (Acetamiprid,Thiacloprid et Thiametoxam)

CONTEXT


Adult
(2-3 months)
Eggs
(4-18 days)
L1-L2
(5-10mm)
L3-L4
(10-15mm)
Larvae
(5 years)
L5-L6
(15-20mm)
L7-L8
(20-22mm)
Pupae
(6-18 days)

CONTEXT



1

B A S E *Biotechnol. Agron. Soc. Environ.* 2014 **18**(4), 524-535

The role of olfaction in wireworms: a review on their foraging behavior and sensory apparatus

Fanny Barsics, Éric Haubruge, Frédéric Francis, François J. Verheggen

After approaching the CO_2 emitter, wireworms uses volatile organic compounds released by the plant in the rhizosphere to select a specific host.

2

Journal of Pest Science
https://doi.org/10.1007/s10340-019-01190-w

ORIGINAL PAPER

Linking variety-dependent root volatile organic compounds in maize with differential infestation by wireworms

Diana la Forgia[1] · Jean-Baptiste Thibord[2] · Philippe Larroudé[2] · Frédéric Francis[1] · Georges Lognay[1] · François Verheggen[1]

Foraging behaviour of wireworms is influenced by belowground volatile organic compounds (VOCs).

AIMS

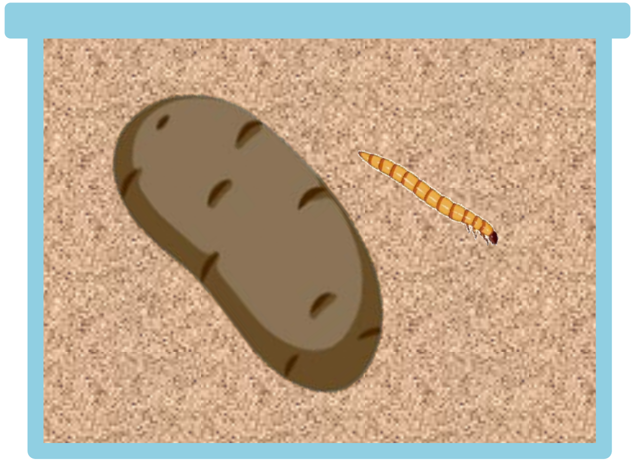
Evaluate the level damage on potato variety under laboratory conditions.
Palatability and the effect on **life history traits**

Assessing the **attractiveness** of **potato varieties** under controlled conditions

Identify the **semiochemical** that could **drive** the **attraction**

ARVALIS

1

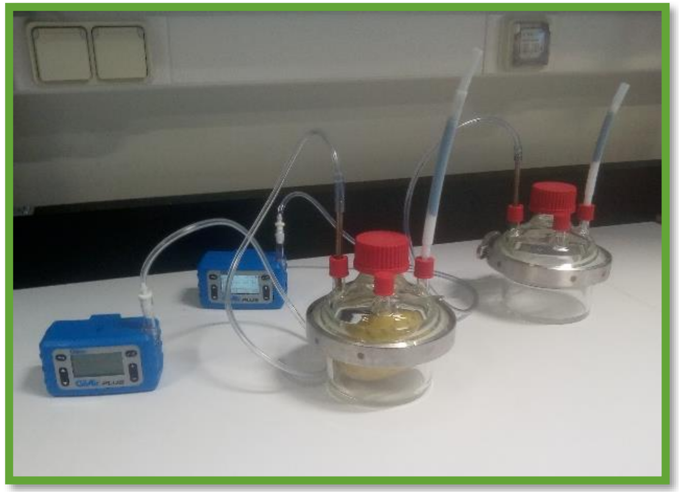


No choice bioassays

2

Dual choice bioassays

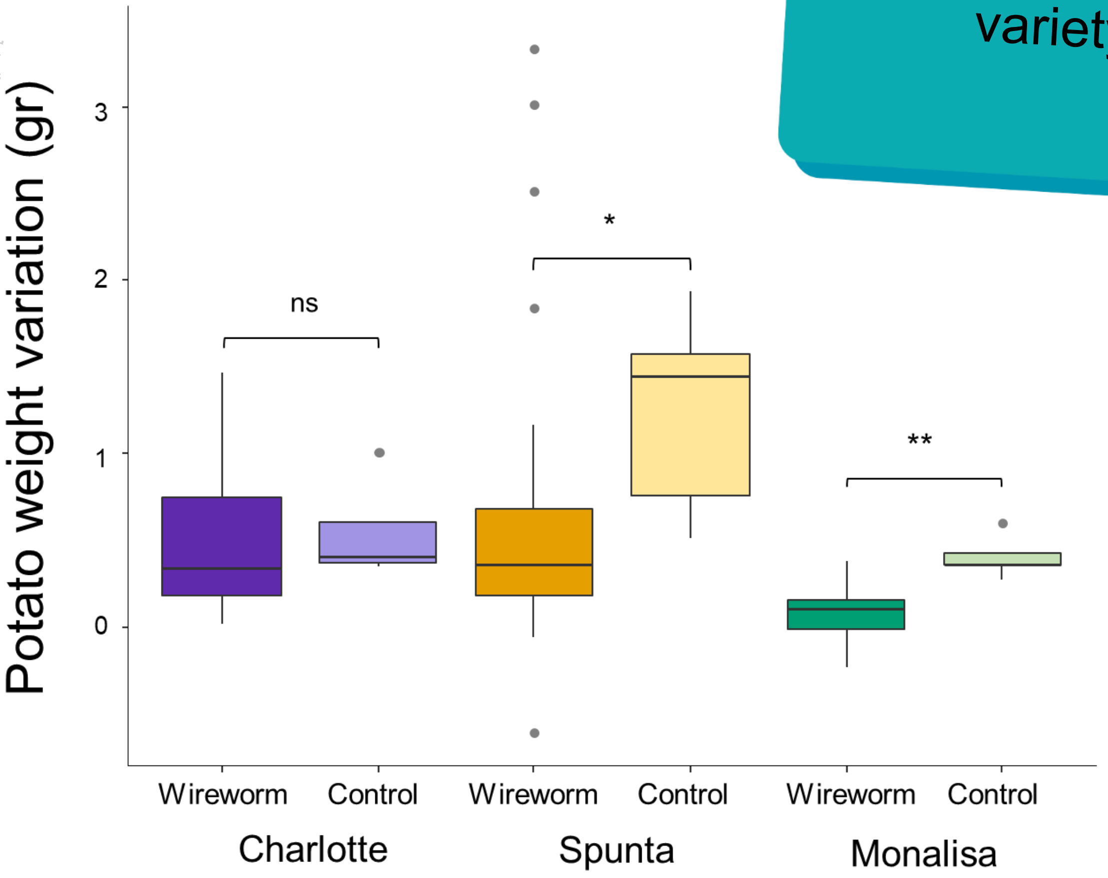
3



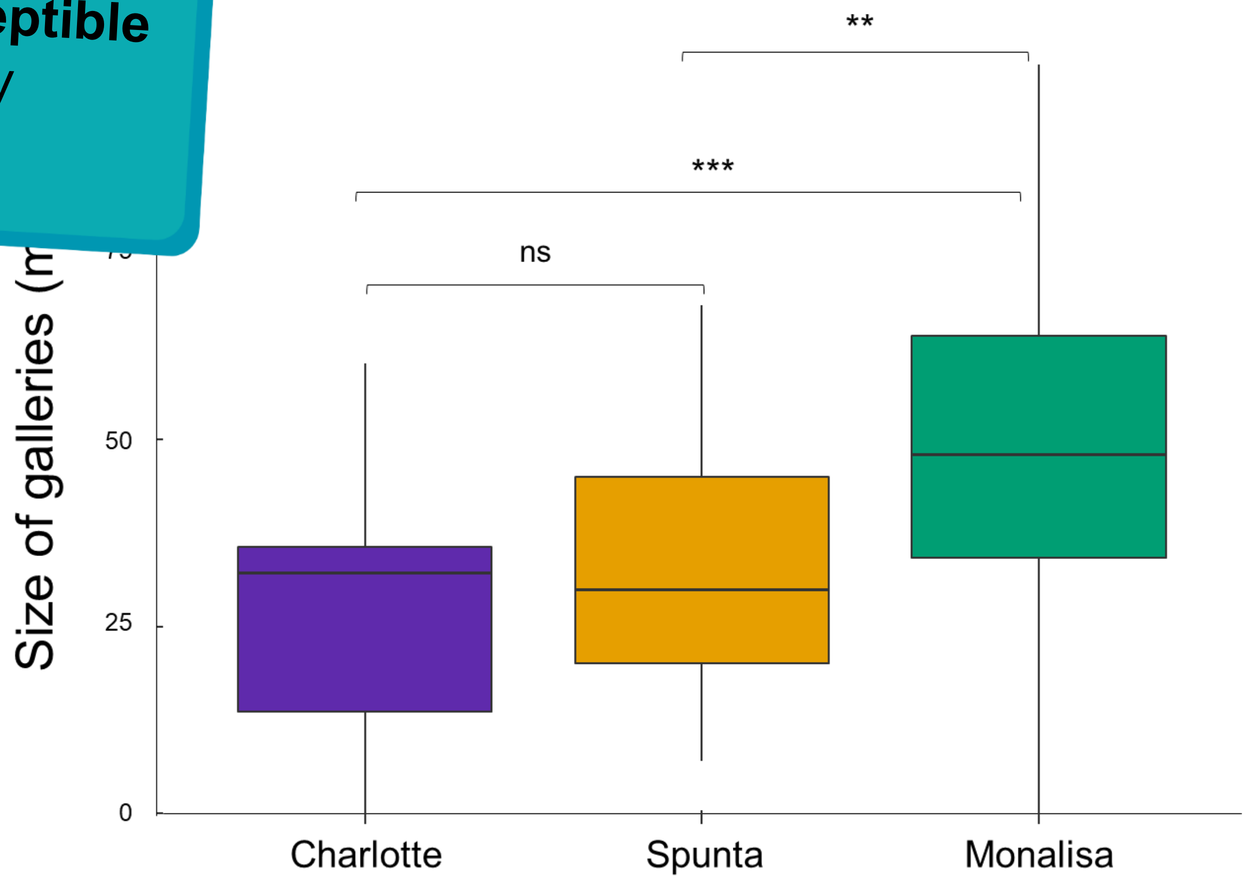
Semiochemical sampling
BBCH 407 and BBCH 409

RESULTS

Monalisa is the most **susceptible** variety



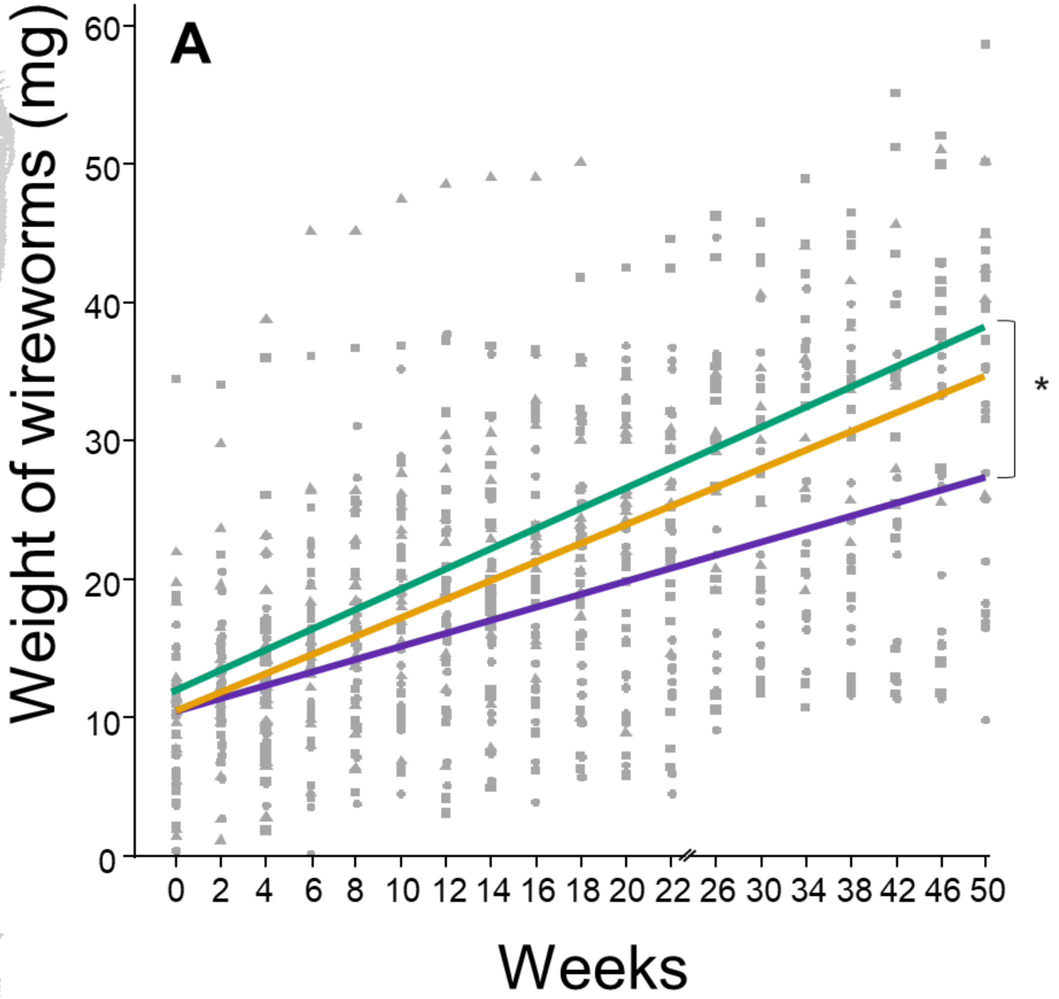
Mann-Whitney-Wilcoxon test



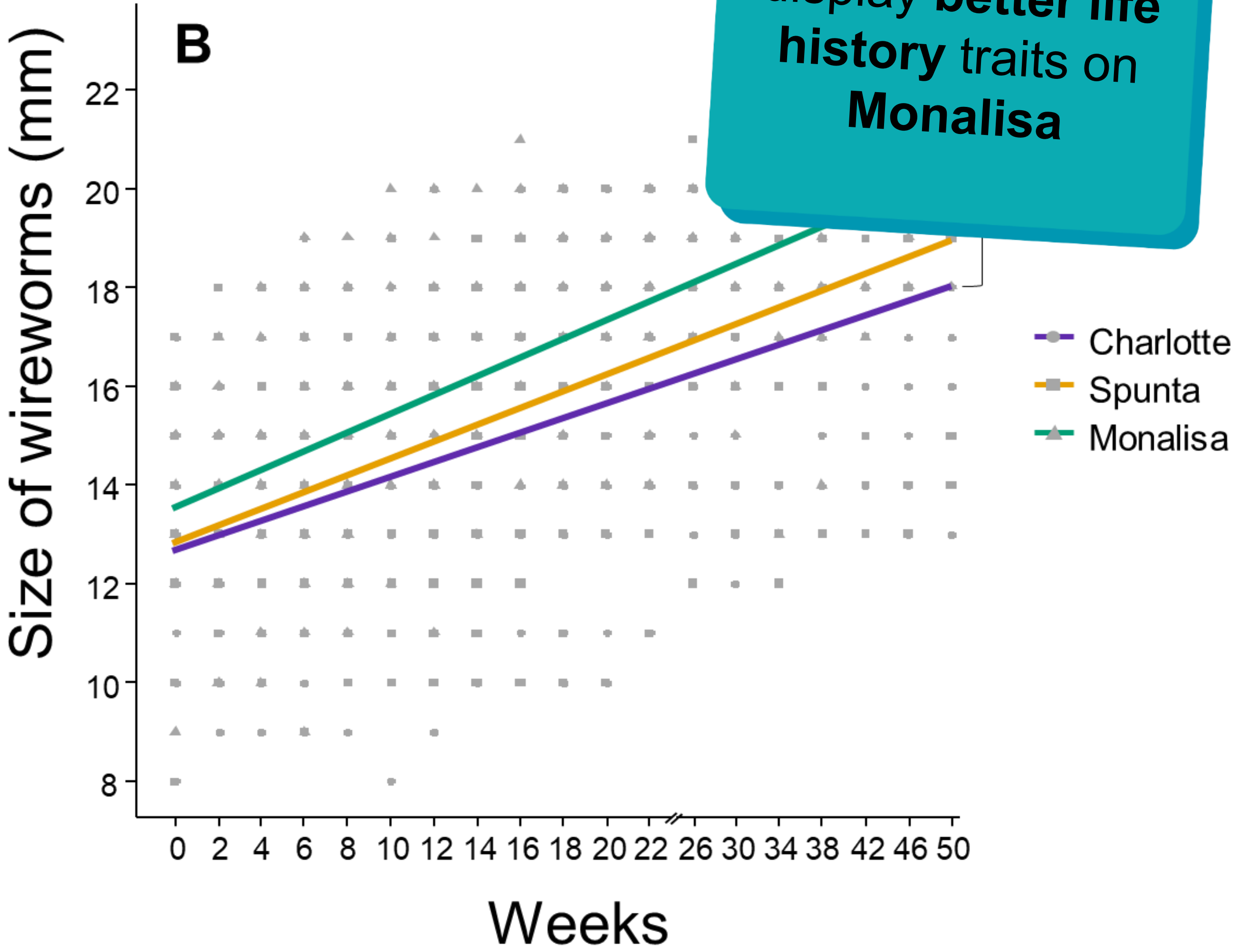
Tukey's HSD test

RESULTS

Wireworms display **better life history** traits on **Monalisa**



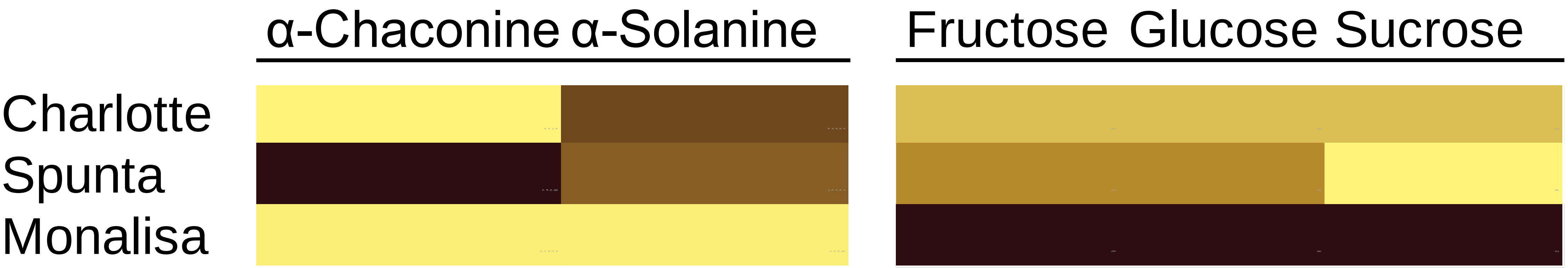
General linear mixed effects models test



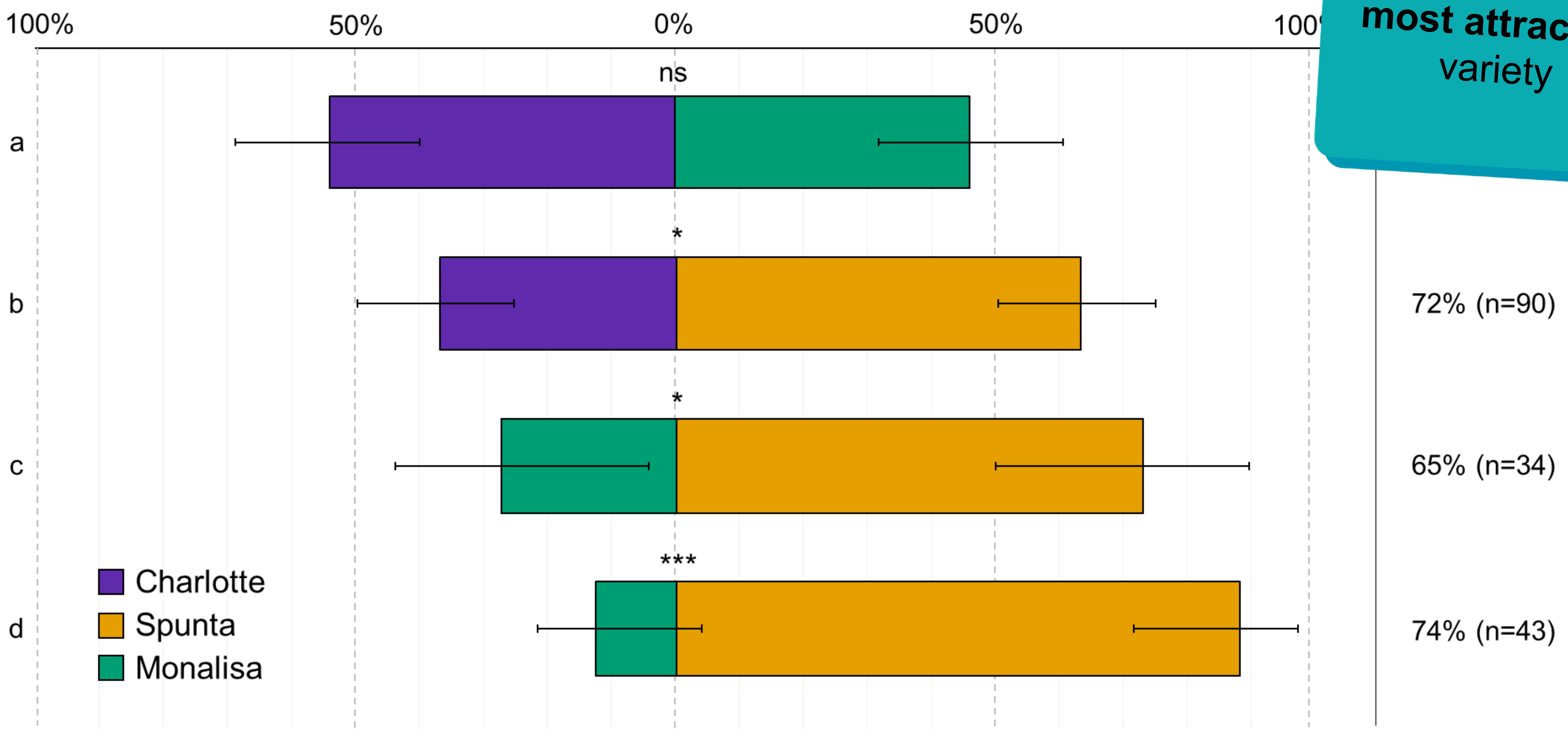
RESULTS

Monalisa presented **lower glycoalkaloid** content and **higher sugar** content.

Glycoalkaloid (µg/kg) and sugar content (g/100g) of potato varieties



ARVALIS
inov3PT SEED POTATO FOR THE FUTURE



Spunta is the **most attractive** variety

Chi-square test

RESULTS

0,02 ng/g → 37,20 ng/g

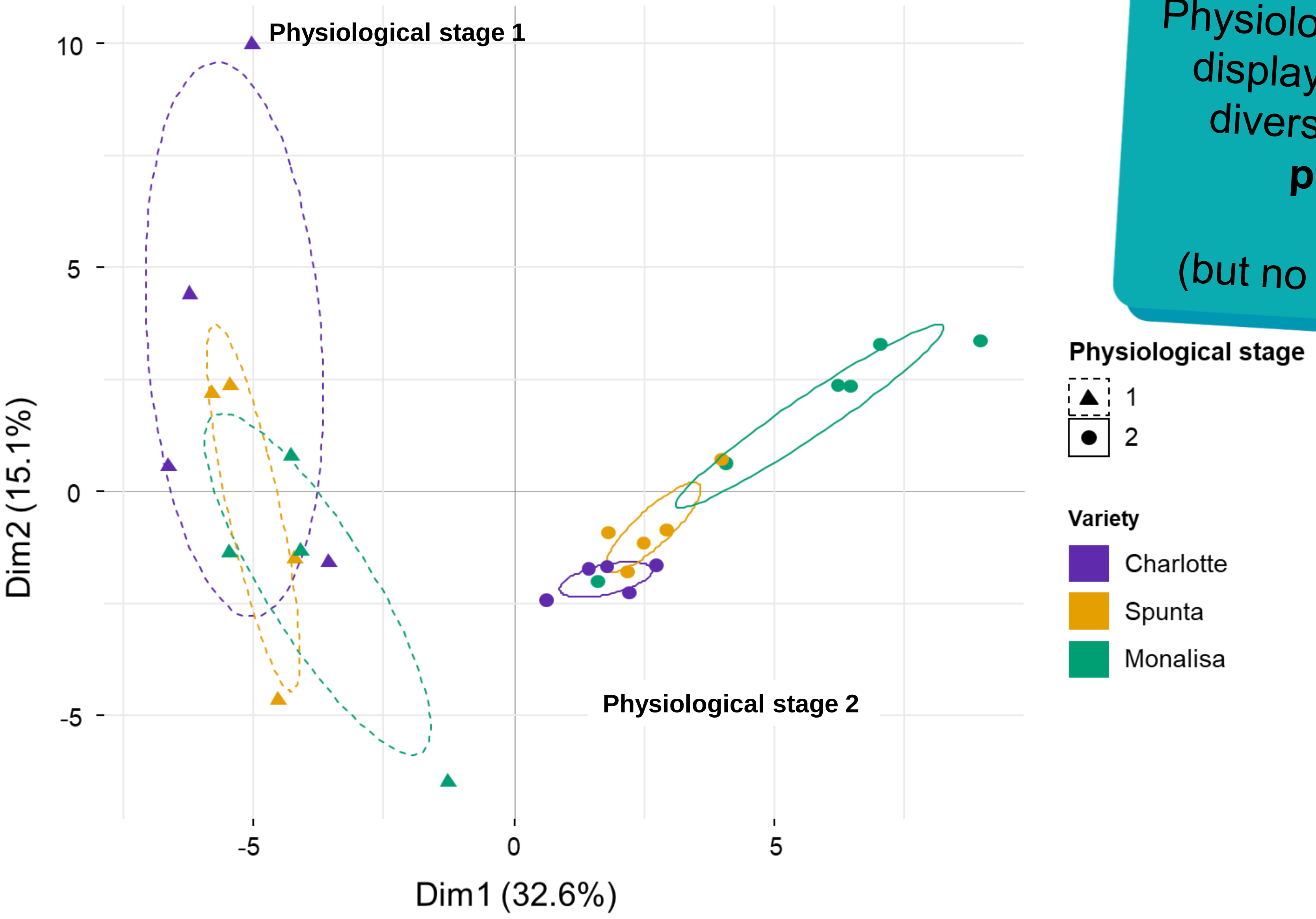
Compounds	Quantity emitted (ng/g of dry peel) (Mean ± S,E,)					
	First physiological stage			Second physiological stage		
	Charlotte	Spunta	Monalisa	Charlotte	Spunta	Monalisa
Aldehydes						
3-Methylbutanal						
Heptanal						
(*E*)-2-Heptenal						
Benzaldehyde						
Octanal						
Benzeneacetaldehyde						
(*E*)-2-Octenal						
(E)-4-Nonenal						
✓ Nonanal						✓
(*E*)-2-Nonenal						
(*E,E*)-2,4-Nonadienal						
(*E*)-2-Decenal						
Alcohols						
3-Methyl-1-butanol						
Propylene glycol						
2,3-Butanediol						
1-Hexanol						
2-Butoxyethanol						
Hexylene glycol						
1-Heptanol						
✓ 1-Octen-3-ol						✓
2-Ethyl-1-hexanol						
Benzyl alcohol						
1-Octanol						
2-Phenyl-2-propanol						
Phenylethyl alcohol						
1-Nonanol						
2-Propyl-1-heptanol						
✓ 2-Phenoxyethanol						✓
1-Decanol						

Compounds	Quantity emitt					
	First physiological st					
	Charlotte	Spunta	M			
Acids and carboxylic acids						
Propanoic acid						
2-Methylpropanoic acid						
3-Methylbutanoic acid						
2-Methylbutanoic acid						
Pentanoic acid						
Ketones						
Butyrolactone						
Pentalactone						
6-Methyl-5-hepten-2-one						
2-Undecanone						
(*E*)-Geranylacetone						
Alkanes and Alkenes						
Heptadecane						
Nonadecane						
Heneicosane						
Sesquiterpenes						
Unidentified Sesquiterper						
Unidentified Sesquiterpene						
Aromatics						
Styrene						
Benzothiazole						
Diisopropylnaphthalene 1						
Diisopropylnaphthalene 2						
Diisopropylnaphthalene 3						
Diisopropylnaphthalene 4						
Diisopropylnaphthalene 5						
Diisopropylnaphthalene 6						
Amines and Amides						
Pyridine						
N-Butylformamide						
Methenamine						
Arenes						
Ethylbenzene						
Furans						
2-Pentylfuran						

65 VOCs identified

most representative
Nonanal
1-octen-3-ol
2-phenoxyethanol

RESULTS



PermManova. Comparison of VOC profiles: physiological stage and variety

Physiological **stage 2** displays the **most** diversified **odor profile**

(but no difference)

Feeding activity is **higher** on **Monalisa tuber**, confirming field observations

Development was significantly better when feeding on the **Monalisa** variety

The **host plant quality** is then assessed by their contents in **primary metabolites** (fatty acids, amino acids, and carbohydrates)

The **volatile** collection analyses could **not** highlight **significant difference** in odor profiles

Nonanal, 1-octen-3-ol, 2-phenoxyethanol, are good candidates to use in **attrack-and-kill strategie**

TO READ

Entomologia Generalis, Volume 43 (2023), Issue 6, 1193–1201
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Article

Potato cultivar susceptibility to wireworms: feeding behaviour, fitness and semiochemical-based host selection

Andrea Chacon Hurtado[1], Fanny Ruhland[1], Antoine Boullis[1], François J. Verheggen[1,*]

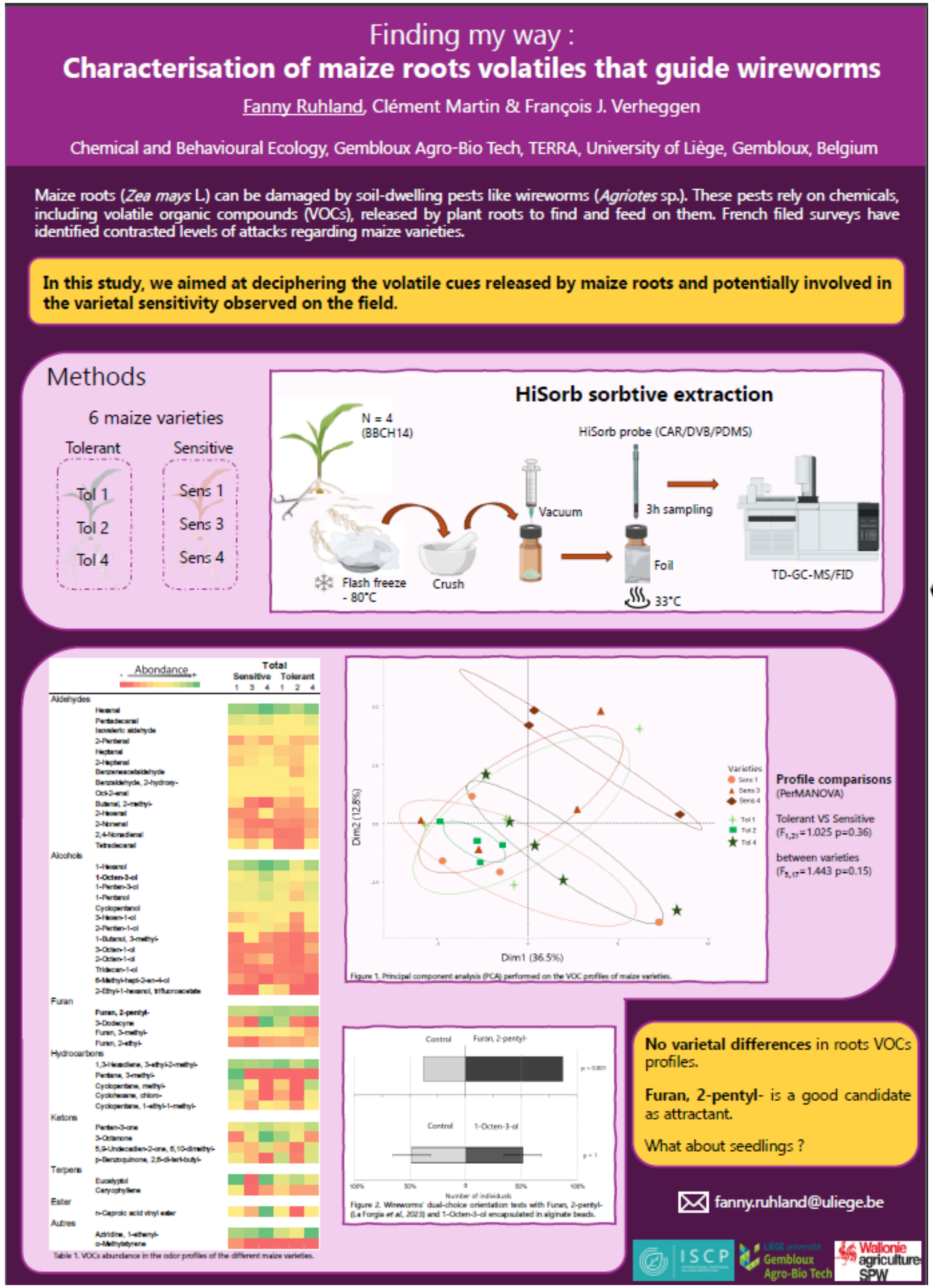
[1] Chemical and Behavioral Ecology, Gembloux Agro-Bio Tech, Université de Liège, Avenue de la Faculté d'Agronomie 2B, 5030, Gembloux, Belgium

François Verheggen's Lab

inov3PT SEED POTATO FOR THE FUTURE

ARVALIS

TO VISIT



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