EOHUB WEBINAR

CYCLE OF CONFERENCES EOHUB

Horizons in Essential Oils.

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EOHUB

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LIÈGE université Gembloux Agro-Bio Tech

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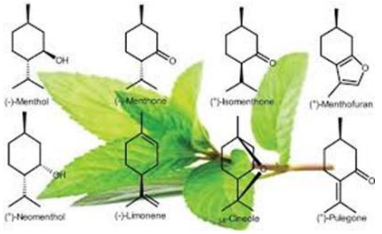
Essential oils for applications in agronomy, what's new?

Conventional uses of EOs :

- Food
- Beverage
- Cosmetics/perfume
- Aromatherapy



- More recently numerous applications in agronomy (biocide)
  - Insecticide (GS 106 000)
  - Herbicide (GS 56 600)
  - Bactericide-fungicide (GS 68 200)
  - Acaricide-nematicide (GS 25 000)

- But also anti-sprouting agent, virucide, soil microbiote quality improvement, post-harvest desease, self-life increase …

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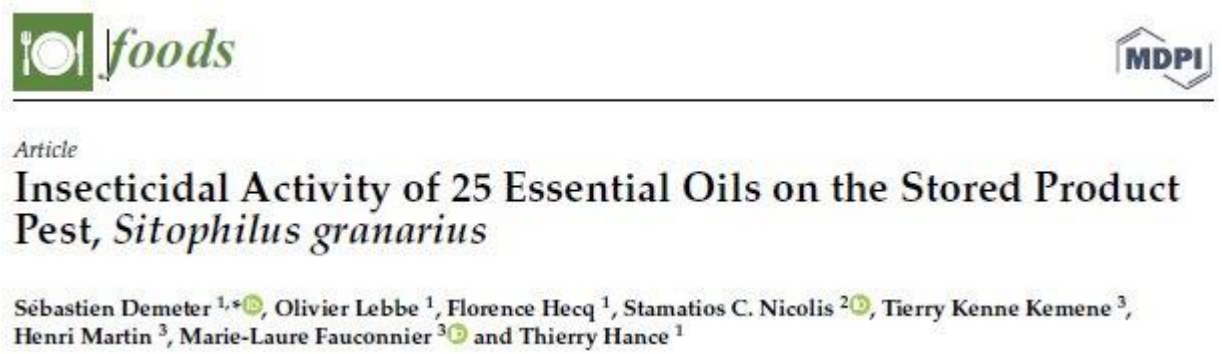
Essential oils for applications in agronomy, what's new?

Eos as insecticide:

- Eos used alone or mixture of it (synergy, additive effect)
- Deterrent, antifeedant, repellent, acute toxicity (ingestion, inhalation, topical application)

➔ Pest of stored food, pest of crops, pest of forests, household pest



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Article

Insecticidal Activity of 25 Essential Oils on the Stored Product Pest, *Sitophilus granarius*

Sébastien Demeter [1,*], Olivier Lebbe [1], Florence Hecq [1], Stamatios C. Nicolis [2], Tierry Kenne Kemene [3], Henri Martin [3], Marie-Laure Fauconnier [3] and Thierry Hance [1]

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Essential oils for applications in agronomy, what's new?

Eos as herbicide: weed control in the context of glyphosate replacement

- Many Eos have herbicidal activity (total or selective and/or antigerminative)

TABLE 24.6
Essential Oils that can be Used in Weed Control

Name Family	Constituents	Notes	Source
Achillea sp. Asteraceae	Camphor, 1,8-cineole, piperitone, borneol, α-terpineol	Inhibitory effect on germination and seedling growth of *A. retroflexus*, *C. arvense*, and *L. serriola*	Kordali et al. (2009)
Ageratum conyzoides L. Asteraceae	Precocene I and II, β-caryophyllene, γ-bisabolene, fenchyl acetate	Causes phytotoxic effects on radish, mungbean, and tomatoes	Kong et al. (1999); Plant Encyclopedia (2012)
Anisomeles indica L. Lamiaceae	Isobornyl-acetate, isothujone, nerolidol, camphene, eugenol	Herbicide against *P. minor*, positive effects on growth of wheat	Batish et al. (2007b); Ushir et al. (2010)
Artemisia scoparia Waldst et Kit. Asteraceae	*p*-Cymene, β-myrcene, (+)-limonene		Kaur et al. (2010)
Callicarpa japonica Thunb. Verbenaceae	Spathulenol, germacrene B, viridiflorol, globulol	Toxic to *A. stolonifera*, but had no such effect on lettuce	Kobaisy et al. (2002)
Carum carvi L. Apiaceae	D-Carvone, limonene	Inhibits germination of *A. retroflexus*, *C. salsotitialis*, *S. arvensis*, *S. oleraceus*, *R. raphanistrum* and *R. nepalensis* and *A. pallida*	Teuscher et al. (2004); Azirek et al. (2008); de Almeida et al. (2010)
Coriandrum sativum L. Apiaceae	Linalol, α-terpinylacetate, 1,8-cineole, linalyacetate	Effective against *C. salsotitialis*, *S. arvensis*, *S. oleraceus*, *R. raphanistrum*, and *R. nepalensis*	
Cymbopogon sp. Poaceae	Citronellal, geraniol, citronellol, citral, limonene		
Eucalyptus sp. Myrtaceae	1,8-Cineole, limonene, α-pinene citronellal, citronellol, linalool, α-terpinene		
Foeniculum vulgare L. Apiaceae	Anethol, fenchone, estragol	Reduces germination rate (under 25%) of *C. salsotitialis*, *S. arvensis* and *R. raphanistrum*	
Hibiscus cannabinus L. Malvaceae	α-Terpineol, myrtenol, limonene, *trans*-carveol and γ-eudesmol	Controls various weeds e.g., *A. retroflexus* and *L. multiflorum*, at higher concentration effective against	

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Handbook c

Handbook of essential oils CRC press ED.

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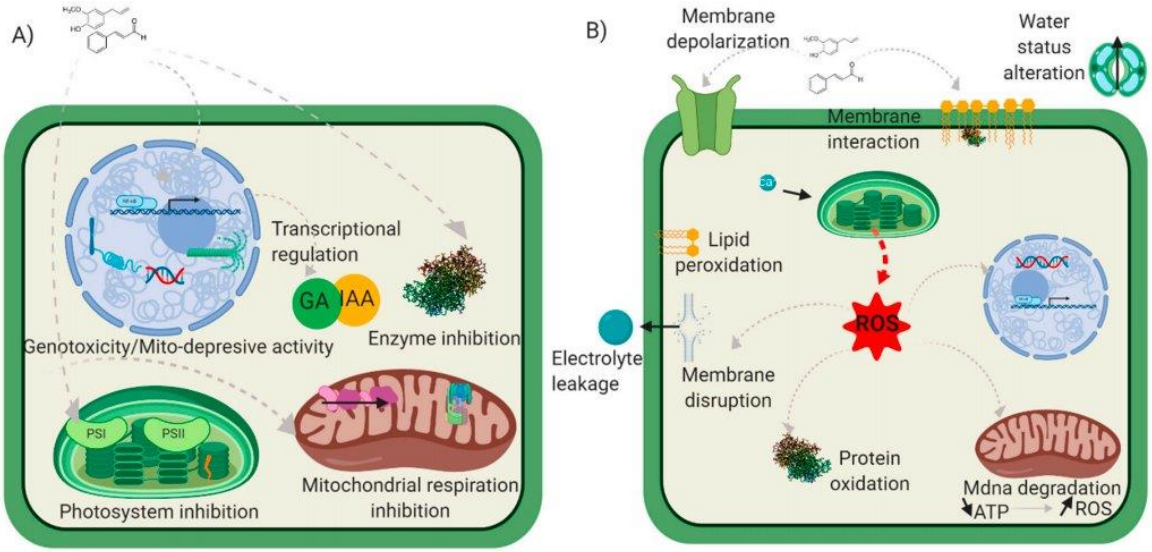
Essential oils for applications in agronomy, what's new?

Eos as herbicide: weed control in the context of glyphosate replacement

Low persistance, multiple action modes (less resistance)



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Review
Phytotoxicity of Essential Oils: Opportunities and Constraints for the Development of Biopesticides. A Review
Pierre-Yves Werrie [1,*], Bastien Durenne [2], Pierre Delaplace [3] and Marie-Laure Fauconnier [1]

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Essential oils for applications in agronomy, what's new?

Eos as bactericide/fungicide

- Bactericide: activity against Gram + and Gram -, various mode of action
- Fungicide but also fungistatic

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Article

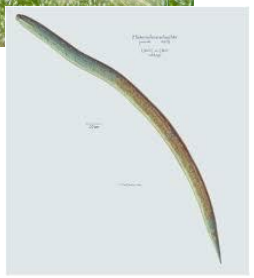
Screening of Antifungal and Antibacterial Activity of 90 Commercial Essential Oils against 10 Pathogens of Agronomical Importance

Caroline De Clerck [1,*,†], Simon Dal Maso [1,†], Olivier Parisi [1], Frédéric Dresen [1], Abdesselam Zhiri [2] and M. Haissam Jijakli [1,*]

Essential oils for applications in agronomy, what's new?

Acaricide: Good results of *Deverra scoparia* EO on *Tetranychus urticae (red spider mite). Repellent, direct mortality, reduced fecundity*

Nematicide : effect of limonene containg Eos and many others on nematodes



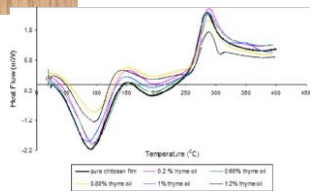
Virucide: tobacco Mosaic virus (lemongrass EO)

Anti-sprouting agent (potatoes, carvone rich EOs)

Soil microbiote improvement: biodegradation but nutriment source for soil µoorganisms

Post-harvest desease: bacteria, fungi

Self-life increase: innovative packging (edible thyme film)



Essential oils for applications in agronomy, what's new?

Advantages and constraints

- Advantages:
  - reduced side effects (human, not target organisms, environment)
  - low persistance
  - multiple action mode (less ressistance)
  - Good acceptability by consumers

- Constraints :
  - Flavour
  - variability (composition)➔ standardization
  - phytotoxicity
  - volatility (encapsulation + new mode of injection)
  - Cost (only for high value crops?)
  - Sustainability of resource
  - Regulatory aspects (US versus EU)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Review

Phytotoxicity of Essential Oils: Opportunities and Constraints for the Development of Biopesticides. A Review

Pierre-Yves Werrie [1,*], Bastien Durenne [2], Pierre Delaplace [3] and Marie-Laure Fauconnier [1]

molecules

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Review

Encapsulation of Essential Oils for the Development of Biosourced Pesticides with Controlled Release: A Review

Chloë Maes [1,2,3,*], Sandrine Bouquillon [1,3,†] and Marie-Laure Fauconnier [2,3,†]

frontiers in Plant Science

ORIGINAL RESEARCH

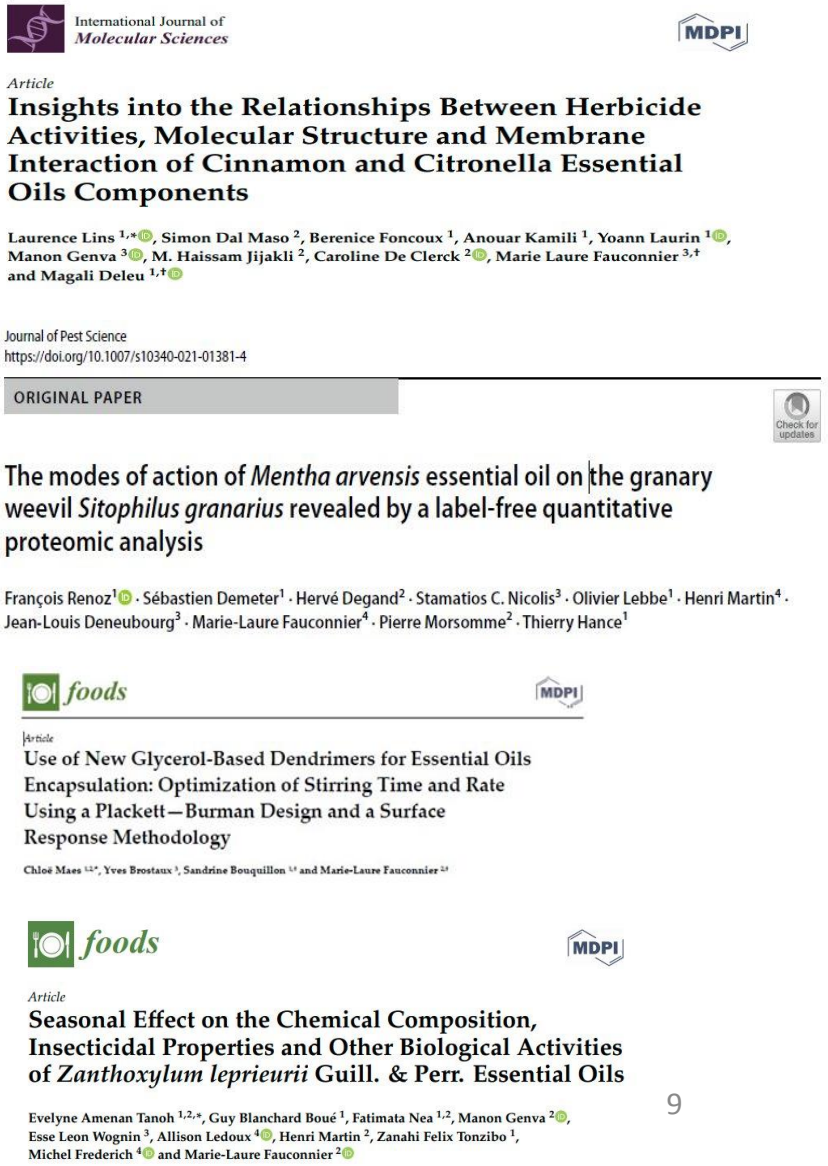
Biopesticide Trunk Injection Into Apple Trees: A Proof of Concept for the Systemic Movement of Mint and Cinnamon Essential Oils

Pierre-Yves Werrie[1*†], Clément Burgeon[1†], Guillaume Jean Le Goff[2], Thierry Hance[2] and Marie-Laure Fauconnier[1]

Essential oils for applications in agronomy, what's new?

Challenges: what's next

- Test *in vitro* ➔ *in vivo*
- Controlled conditions versus field conditions
- Comprehesion of mode of action (structure-activity relationship)
- Innovative formulation
- Exploring new EOs



International Journal of *Molecular Sciences* — MDPI

Article

Insights into the Relationships Between Herbicide Activities, Molecular Structure and Membrane Interaction of Cinnamon and Citronella Essential Oils Components

Laurence Lins [1,*], Simon Dal Maso [2], Berenice Foncoux [1], Anouar Kamili [1], Yoann Laurin [1], Manon Genva [3], M. Haissam Jijakli [2], Caroline De Clerck [2], Marie Laure Fauconnier [3,†] and Magali Deleu [1,†]

Journal of Pest Science
https://doi.org/10.1007/s10340-021-01381-4

ORIGINAL PAPER

Check for updates

The modes of action of *Mentha arvensis* essential oil on the granary weevil *Sitophilus granarius* revealed by a label-free quantitative proteomic analysis

François Renoz[1] · Sébastien Demeter[1] · Hervé Degand[2] · Stamatios C. Nicolis[3] · Olivier Lebbe[1] · Henri Martin[4] · Jean-Louis Deneubourg[3] · Marie-Laure Fauconnier[4] · Pierre Morsomme[2] · Thierry Hance[1]

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Article

Use of New Glycerol-Based Dendrimers for Essential Oils Encapsulation: Optimization of Stirring Time and Rate Using a Plackett—Burman Design and a Surface Response Methodology

Chloé Maes [1,2,*], Yves Brostaux [3], Sandrine Bouquillon [1,†] and Marie-Laure Fauconnier [2,†]

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Article

Seasonal Effect on the Chemical Composition, Insecticidal Properties and Other Biological Activities of *Zanthoxylum leprieurii* Guill. & Perr. Essential Oils

Evelyne Amenan Tanoh [1,2,*], Guy Blanchard Boué [1], Fatimata Nea [1,2], Manon Genva [2], Esse Leon Wognin [3], Allison Ledoux [4], Henri Martin [2], Zanahi Felix Tonzibo [1], Michel Frederich [4] and Marie-Laure Fauconnier [2]

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