



Università di Napoli Federico II



Chimica organica e Agraria: più vicine di quanto sembri

Virginia Lanzotti



Portici, 3 Giugno 2020



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La Chimica organica è la chimica del carbonio

Composti naturali



Costituenti principali
di animali e piante



Metaboliti primari
Metaboliti secondari

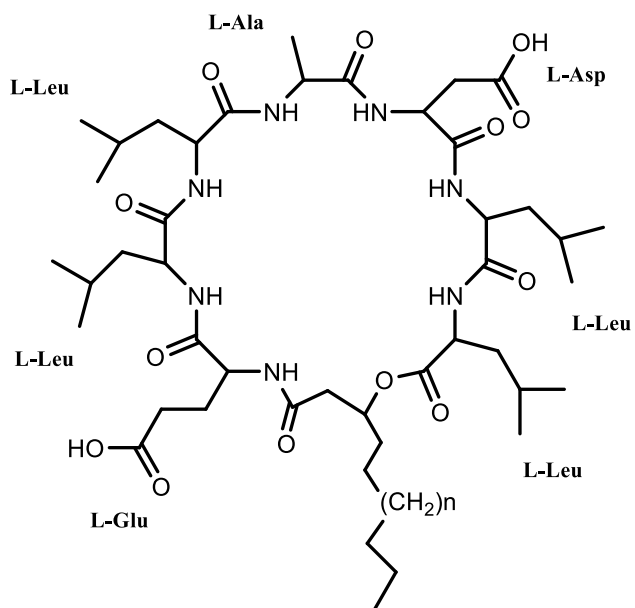
Composti sintetici



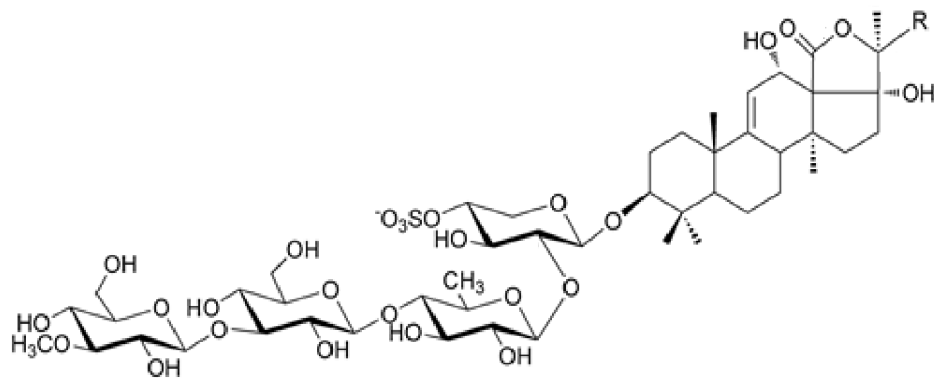
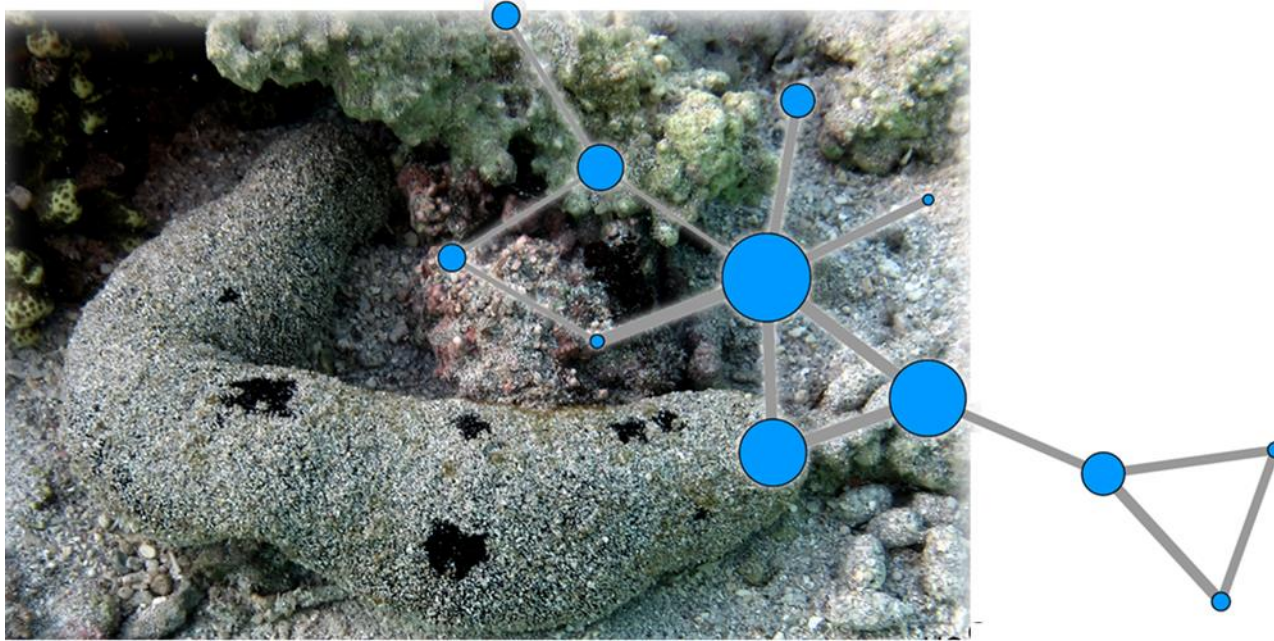
Farmaci, detergenti,
polimeri, coloranti,
fibre....



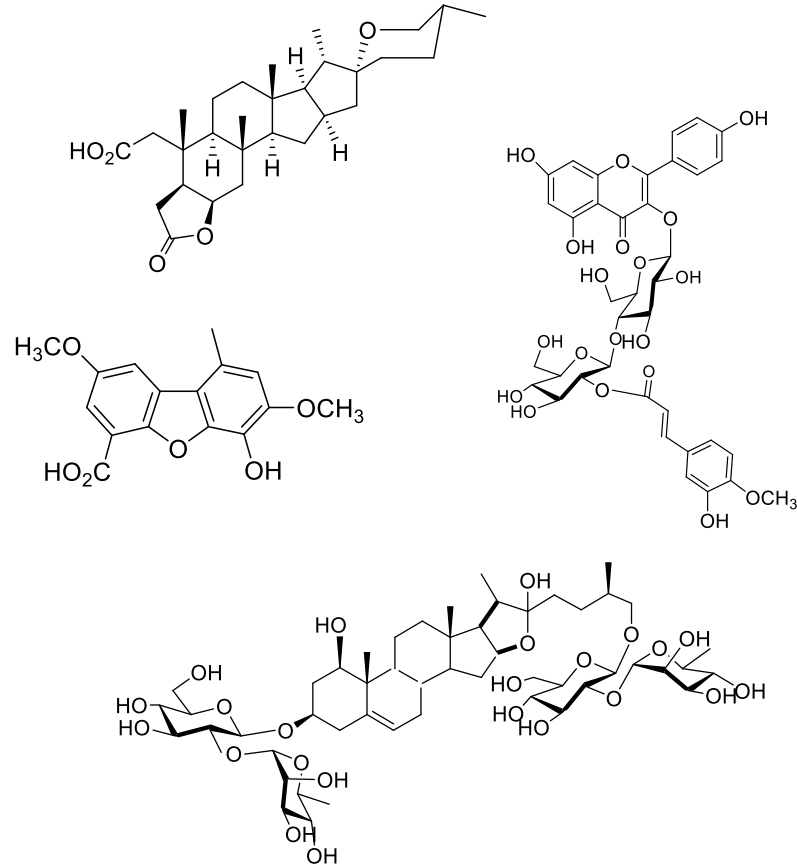
Natural Product Research



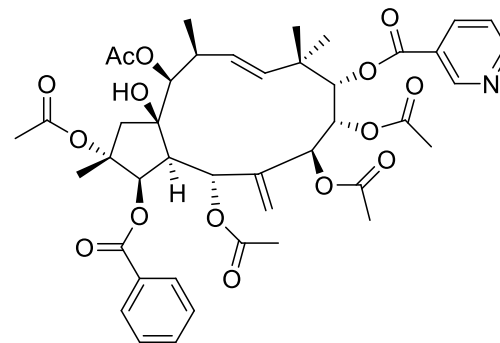
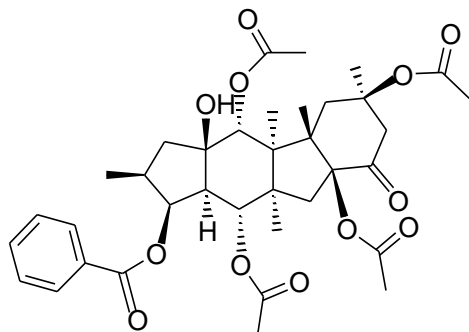
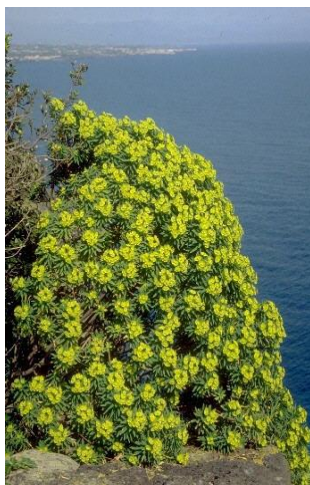
Natural Product Research



Bioactive compounds from *Allium*



Bioactive compounds from *Euphorbia*

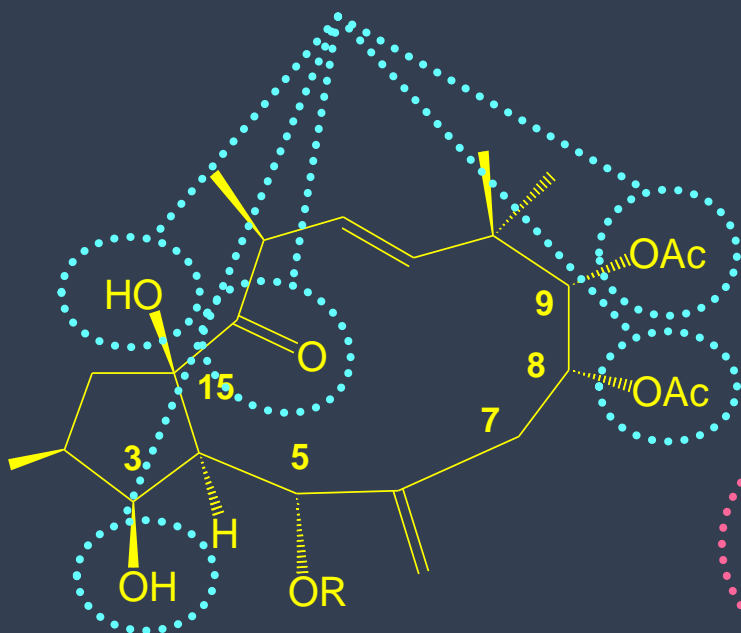


G. Corea et al. *J. Med. Chem.* **2003**, **2004**, **2005**
E Barile et al. *Org. Lett.* **2007**, *Org. Biomol. Chem.* **2008**

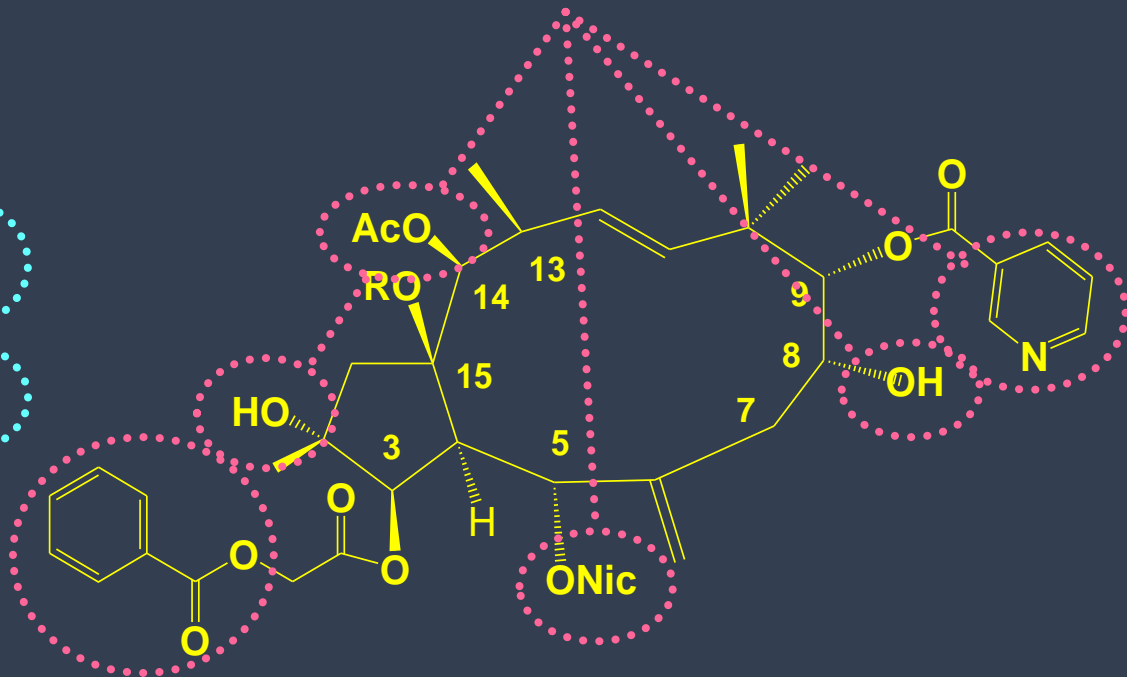
Structure Activity Relationship (SAR) studies

MultiDrug Resistance

INCREASE POTENCY

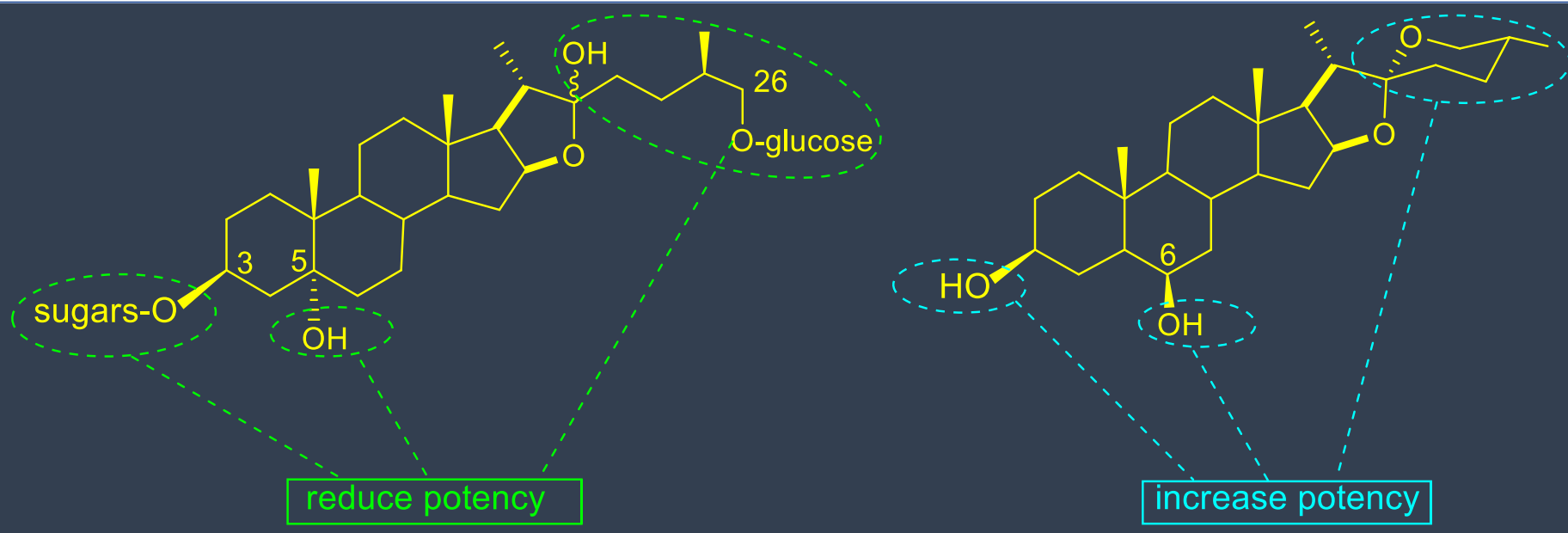


REDUCE POTENCY



Structure Activity Relationship (SAR) studies

Antifungal activity



Alternaria alternata

Botrytis cinerea

Alternaria porri

Fusarium solani

Fusarium oxysporum

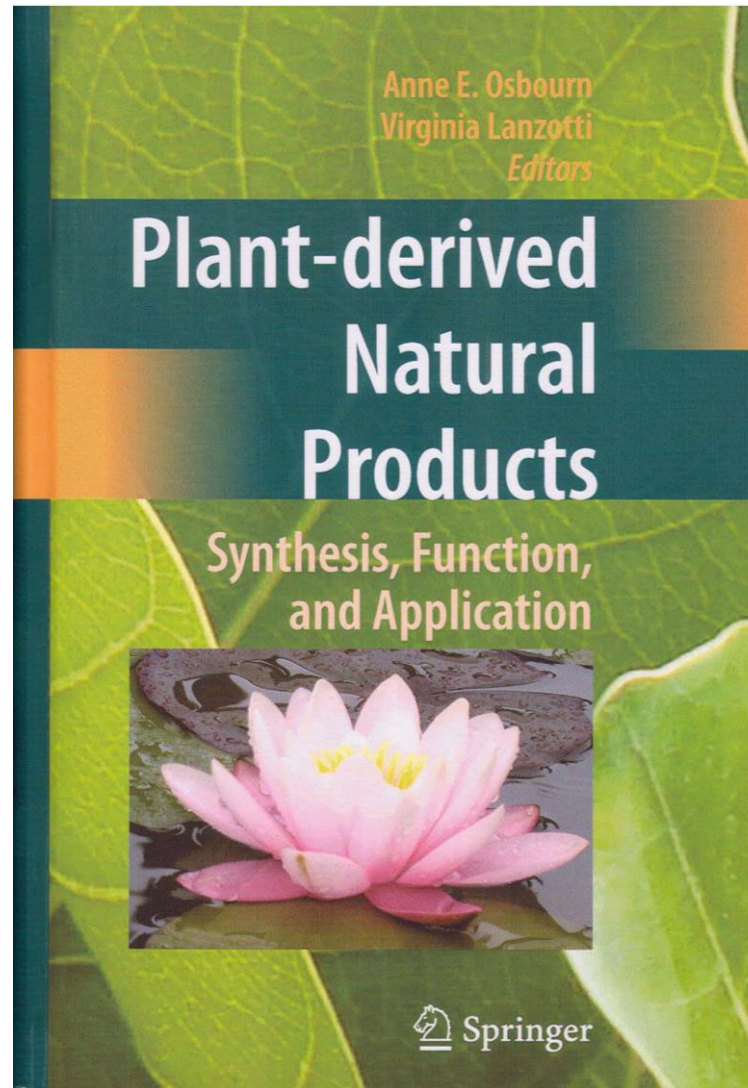
Fusarium lycopersici

Rhizoctonia solanii

Pythium ultimum

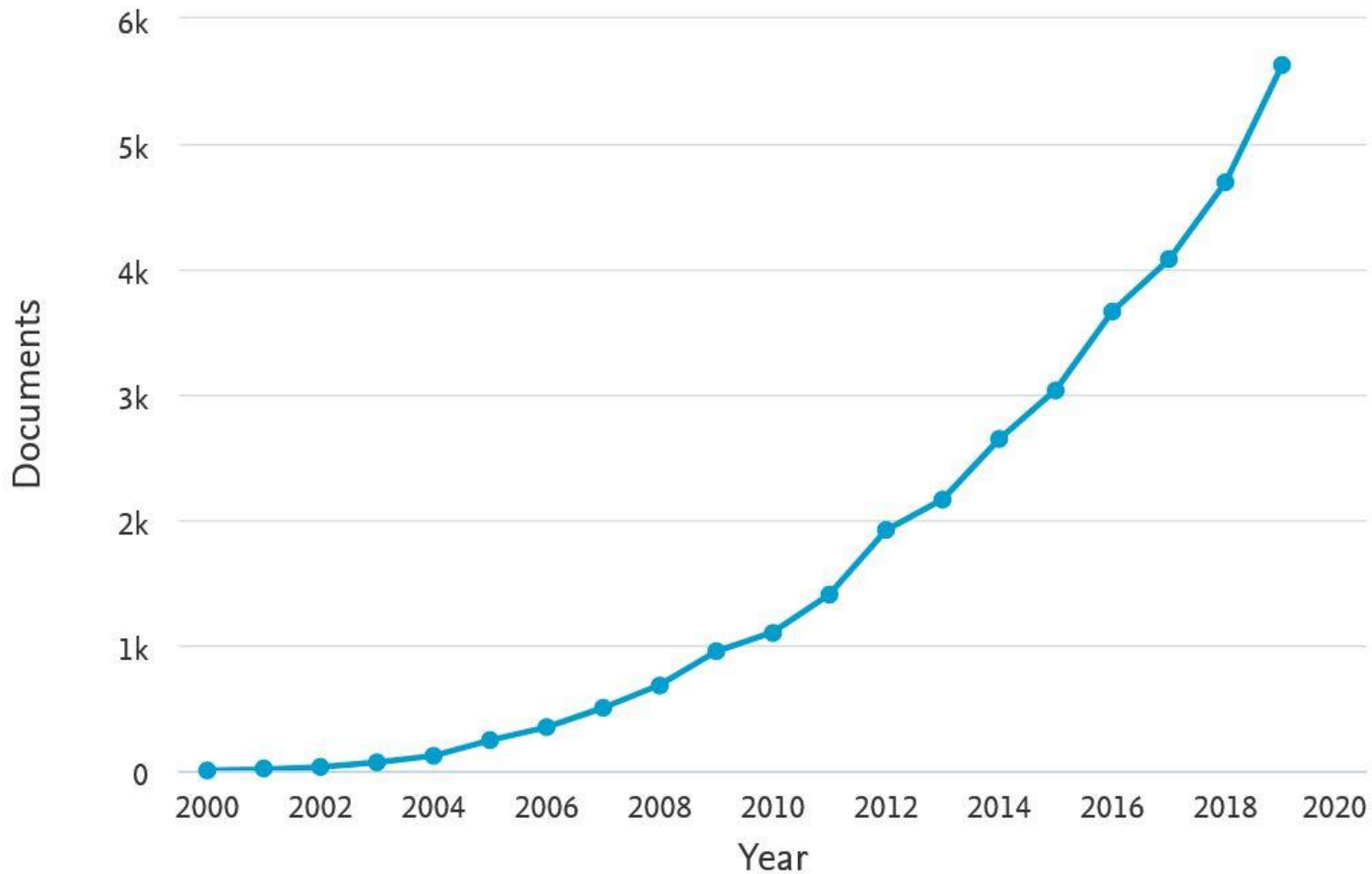
Trichoderma harzianum

Metabolomics as a New Trend



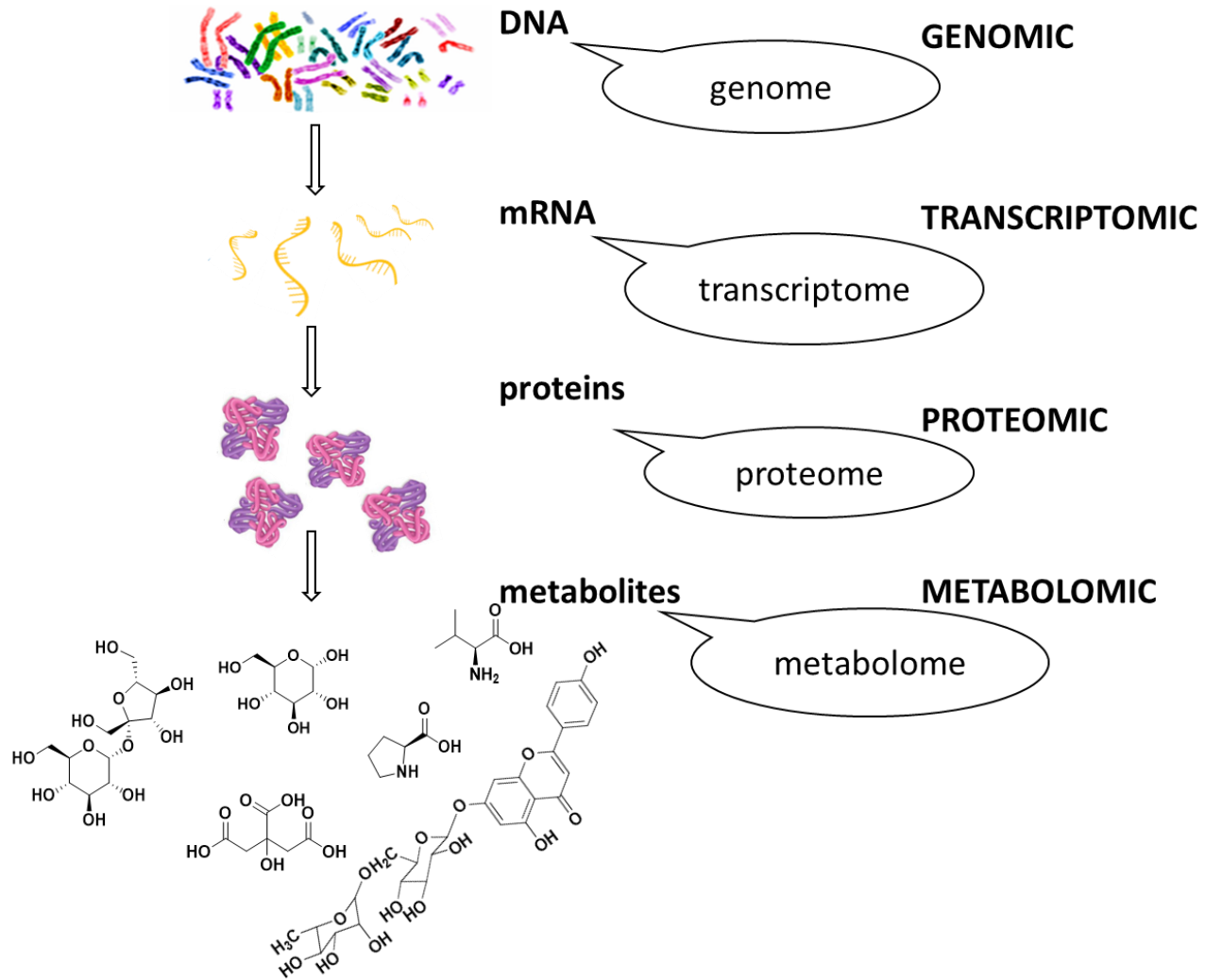
A.E. Osbourn, V. Lanzotti (Eds) **2009**, Springer, New York

Metabolomics

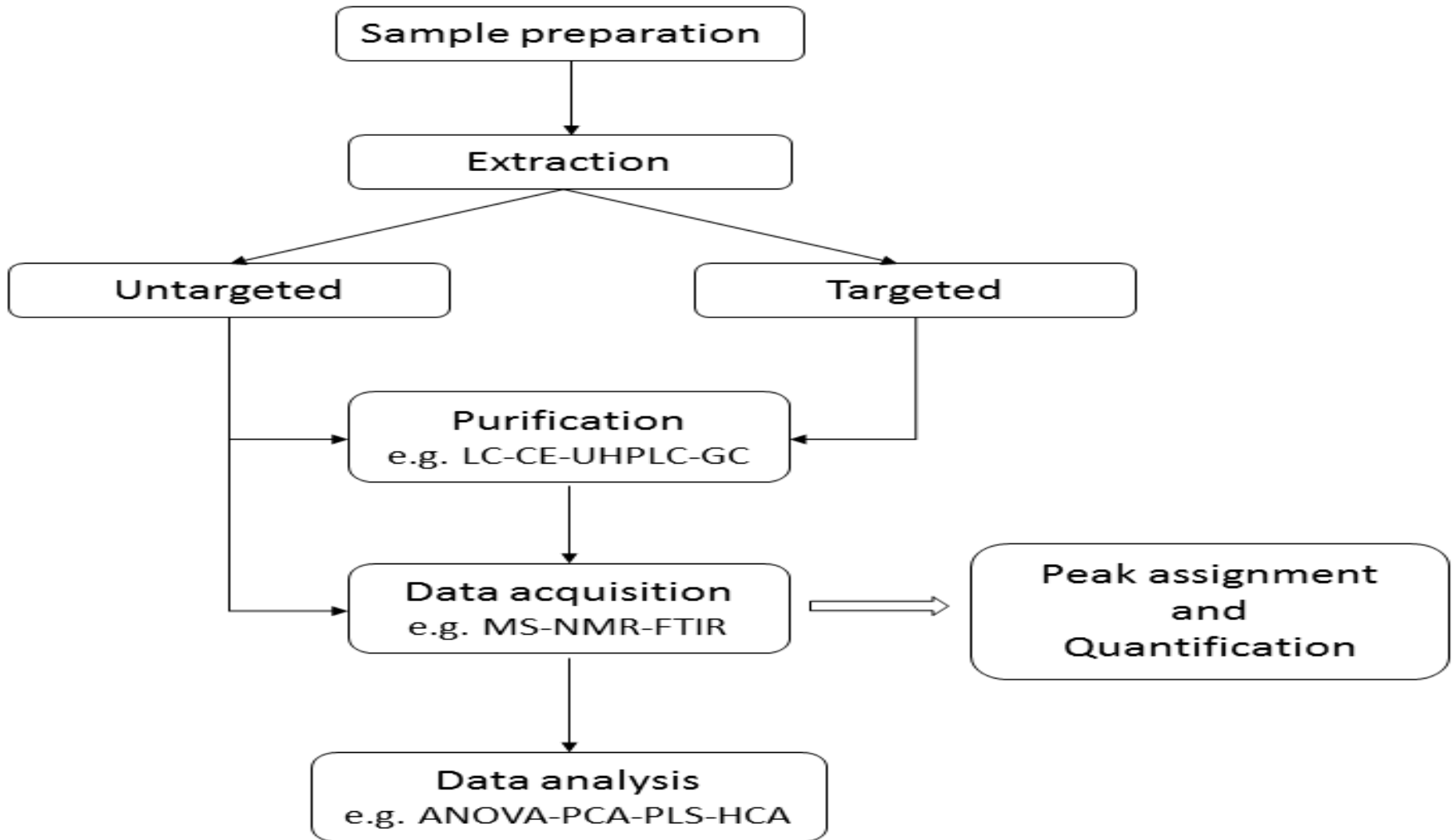


Scopus research on publications containing the term “metabolomics”

Omics



Metabolomic fingerprinting



Mediterranean plants



Acanthus mollis



Dittrichia viscosa



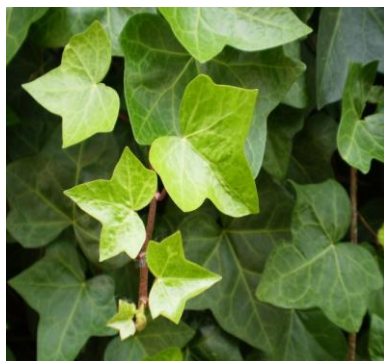
Festuca drymeja



Fraxinus ornus



Fagus sylvatica



Hedera helix

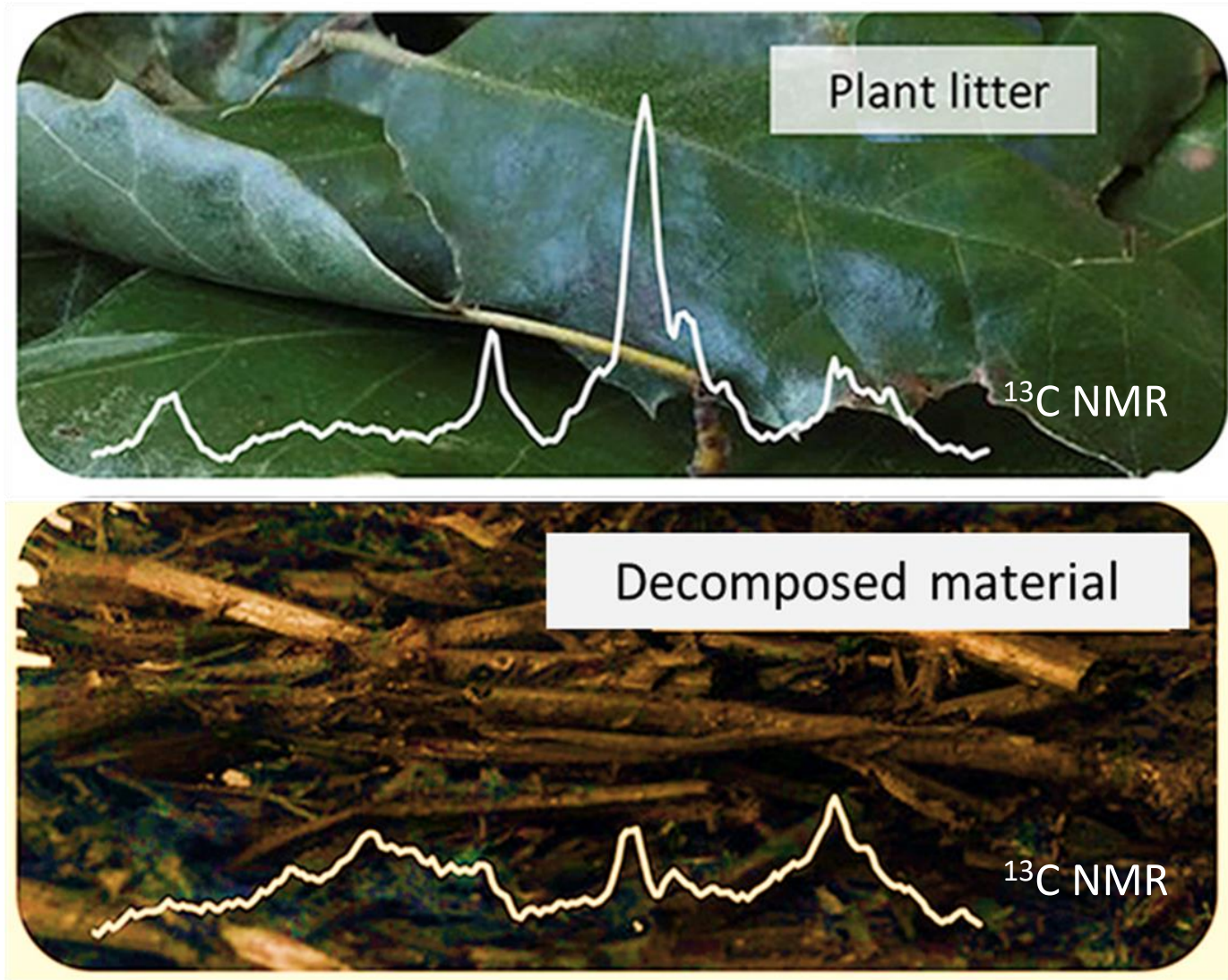


Quercus ilex

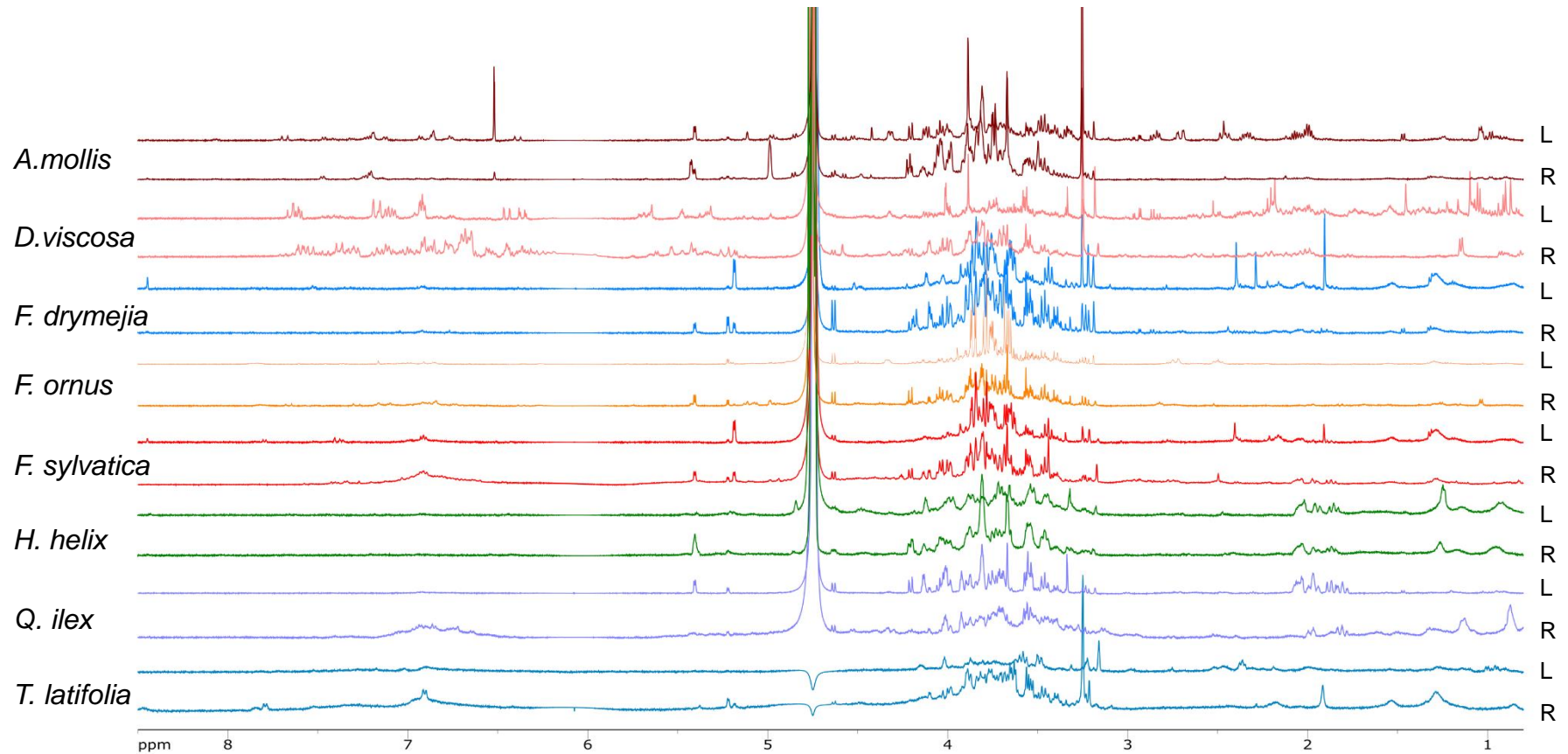


Typha latifolia

Litter decomposition in natural ecosystems



Metabolomic fingerprinting of Mediterranean plants



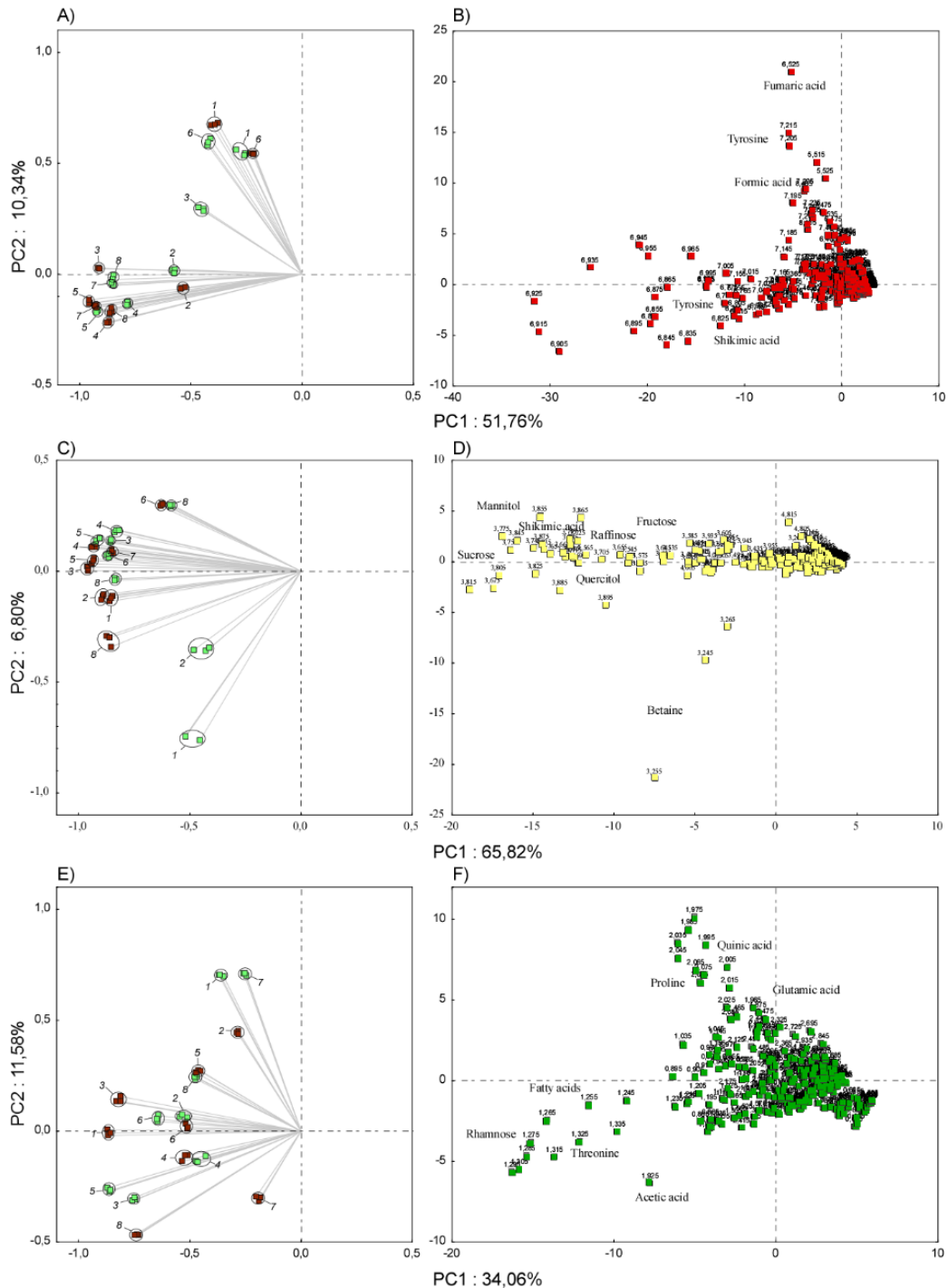
$^1\text{H-NMR}$ at 400 MHz in D_2O of leaves (L) and roots (R) of Mediterranean species.

Metabolomic fingerprinting of Mediterranean plants

Principal component analysis (PCA) of ¹H NMR resonance intervals

1. *A. mollis*
2. *D. viscosa*
3. *F. drimejja*
4. *F. ornus*
5. *F. sylvatica*
6. *H. helix*
7. *Q. ilex*
8. *T. latifolia*

- Root extracts
- Carbohydrates 3.10-5.5 ppm
- Leaves extracts
- Aliphatics 0.5-3.10 ppm
- Aromatics/phenols 5.5-8.5 ppm



Food plants: Artichoke heads

Cynara cardunculus

Antioxidant

Choleretic

Anticholestatic

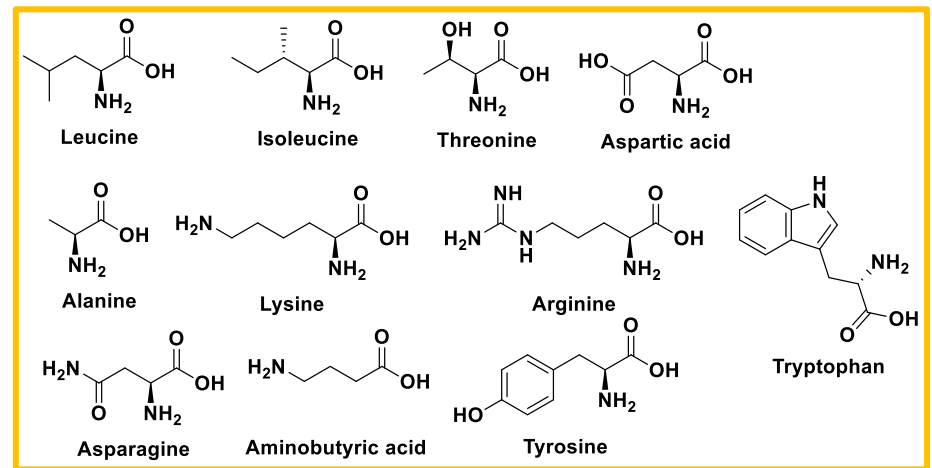
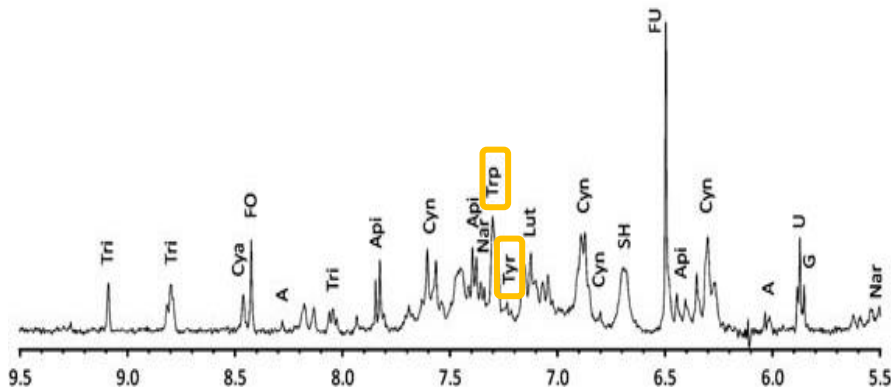
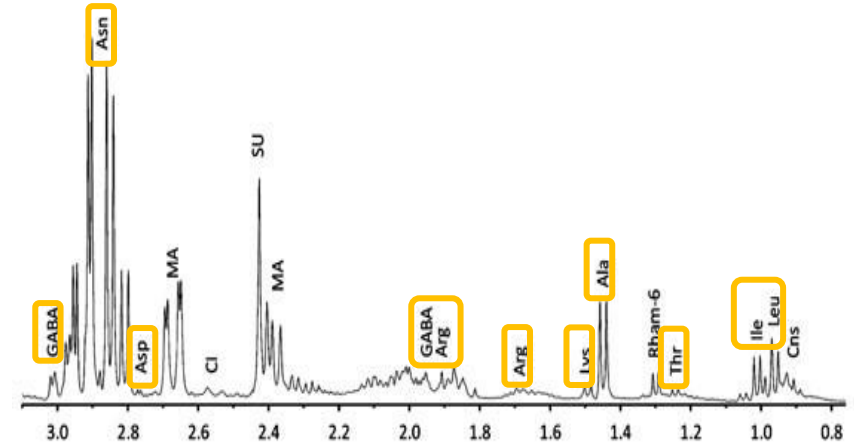
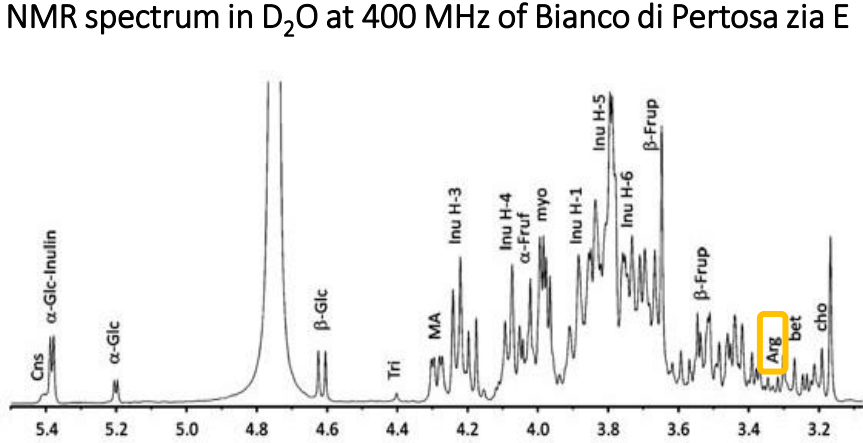
Hepatoprotective

Antihyperlipidemic



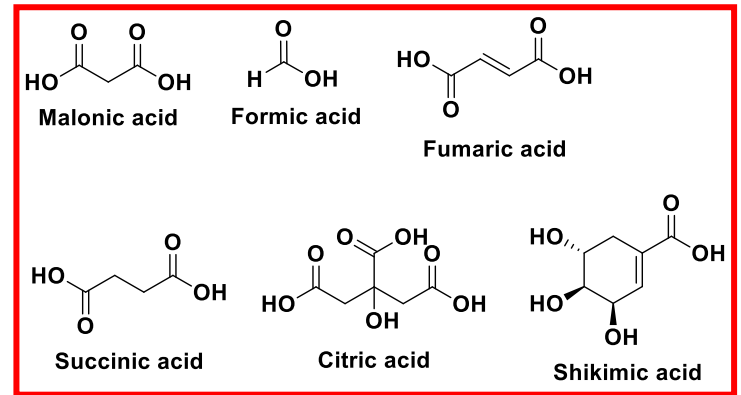
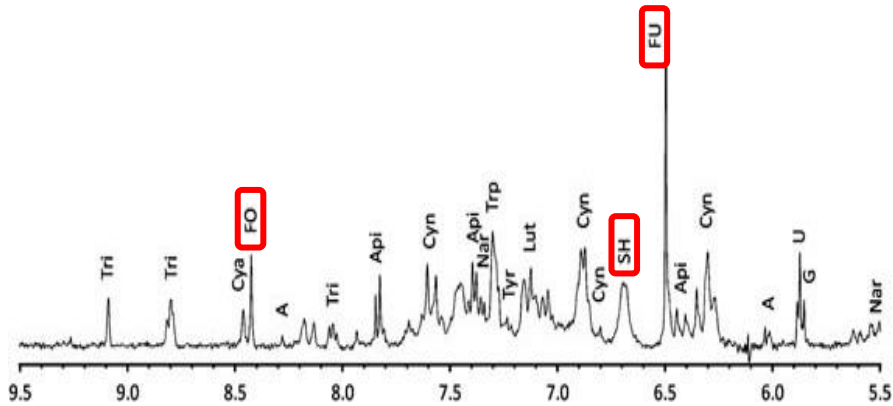
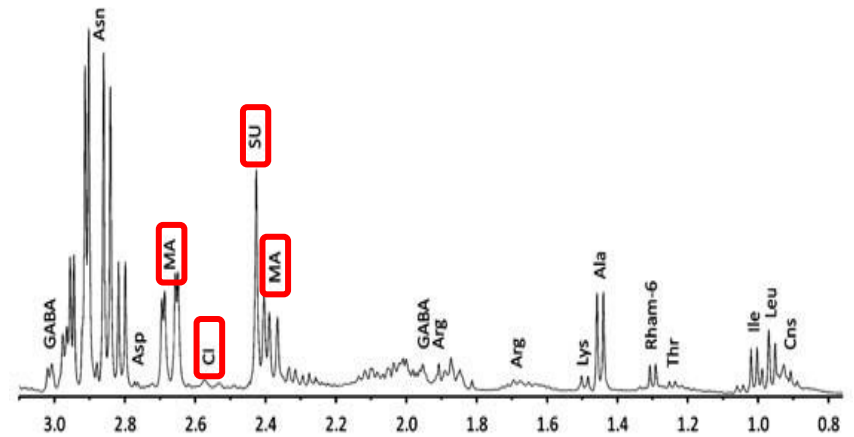
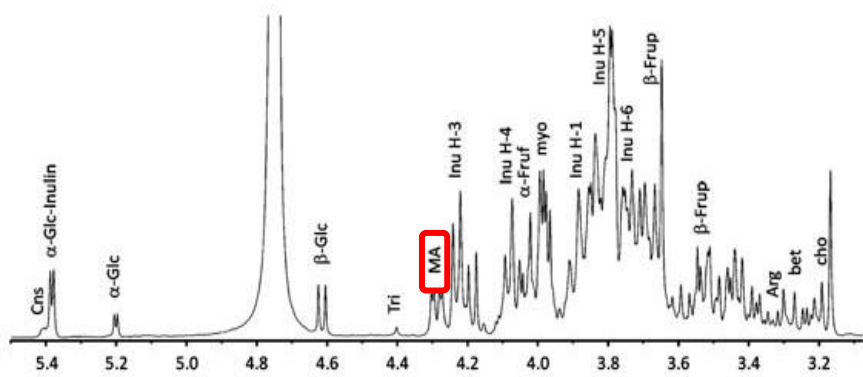
Artichoke: spectroscopic analysis

^1H NMR spectrum in D_2O at 400 MHz of Bianco di Pertosa zia E



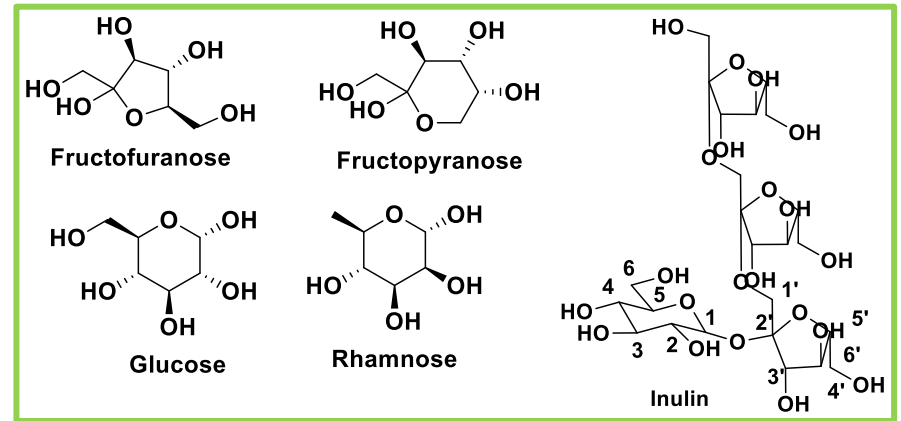
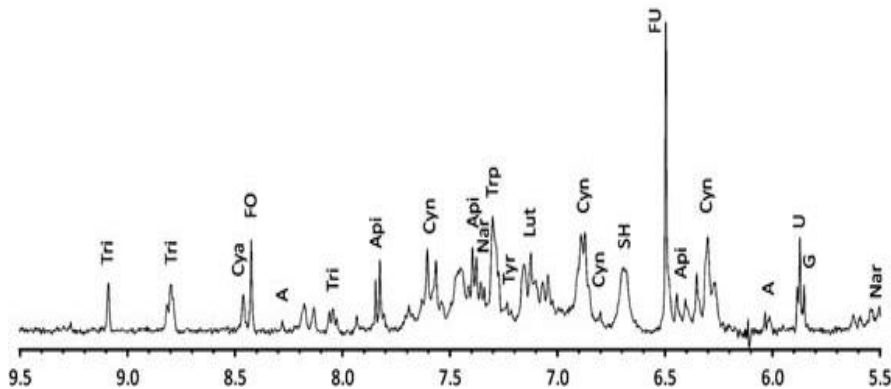
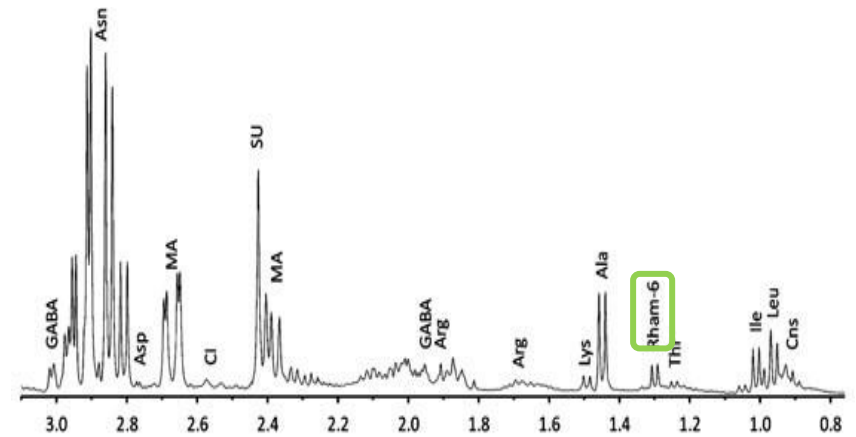
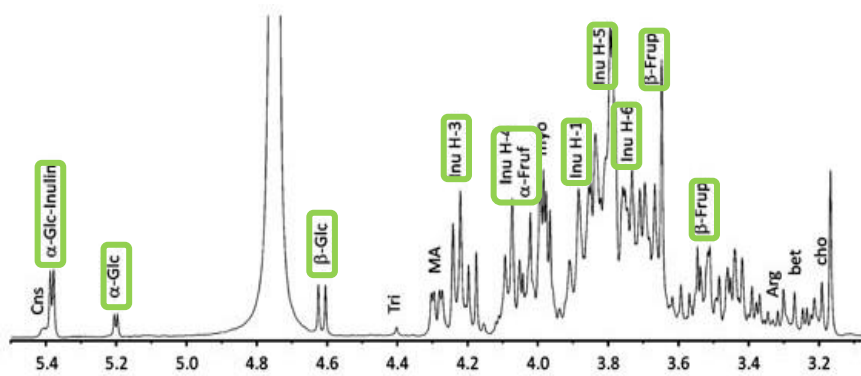
Artichoke: spectroscopic analysis

^1H NMR spectrum in D_2O at 400 MHz of Bianco di Pertosa zia E



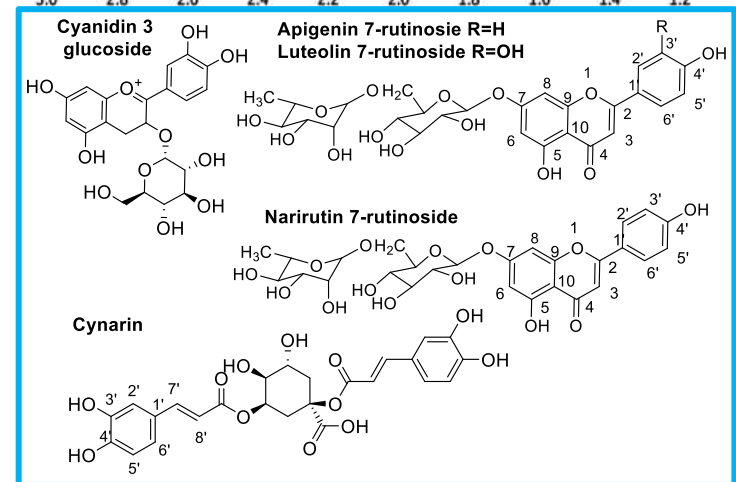
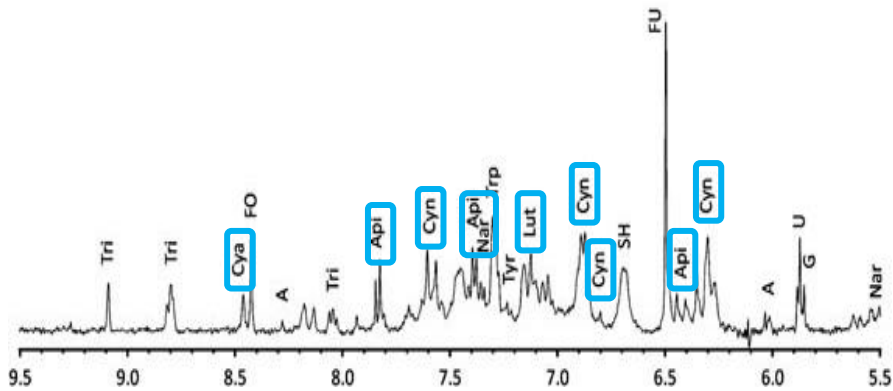
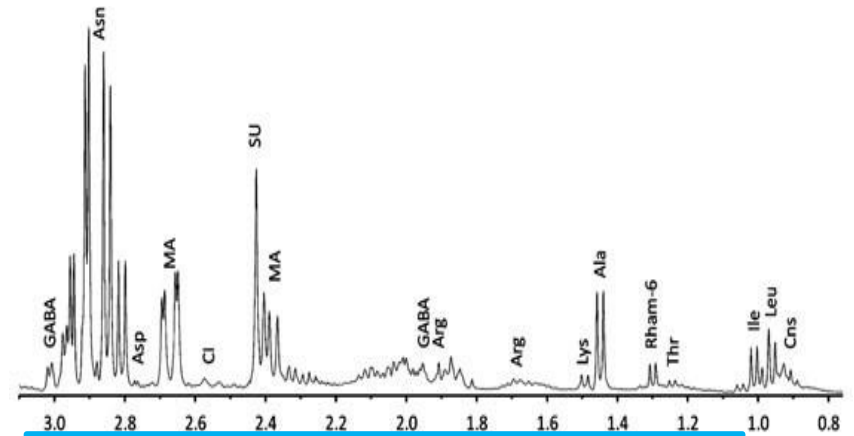
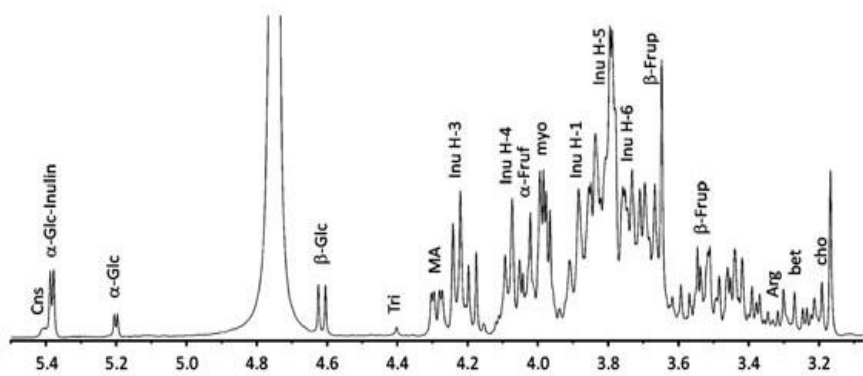
Artichoke: spectroscopic analysis

^1H NMR spectrum in D_2O at 400 MHz of Bianco di Pertosa zia E



Artichoke: spectroscopic analysis

^1H NMR spectrum in D_2O at 400 MHz of Bianco di Pertosa zia E



Food plants: Chia seeds

Salvia hispanica

Antioxidant

Antiarhythmic

Antithrombotic

Anti-inflammatory

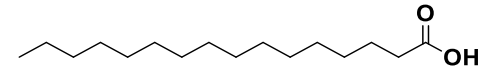


B. de Falco et al. *Food Chem.* **2018**

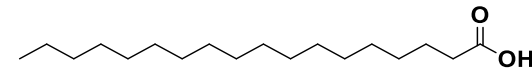
B. de Falco et al. *Ind. Crops Prod.* **2017, 2018**

Chia: GC-MS of organic fraction

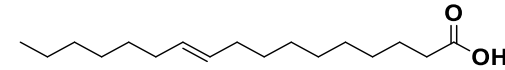
	Metaboilites	RT
28	Palmitic Acid	17.88
29	Linoleic acid	19.54
30	α -Linolenic acid	19.61
31	Stearic acid	19.80
32	Oleic acid	22.07
33	10-Heptadecenoic acid	24.05
34	Glycerol monostearate	24.34



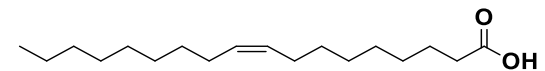
Palmitic acid C16:0



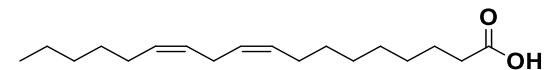
Stearic acid C18:0



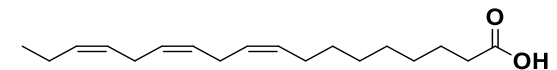
10-Heptadecenic acid C17:1



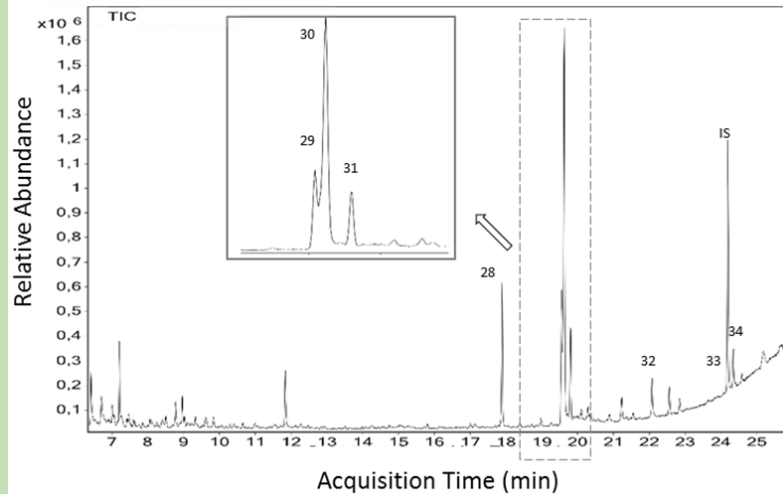
Oleic acid C18:1



Linoleic acid C18:2



Linolenic acid C18:3



Wild food plants

Taraxacum officinale



Urtica dioica



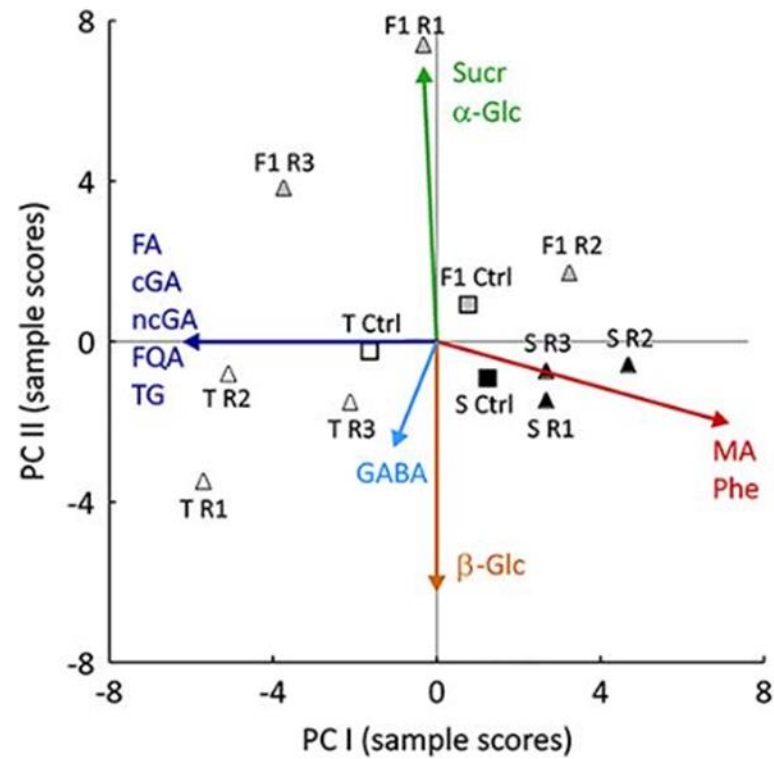
Papaver rhoeas



Metabolite profiling of tomato varieties

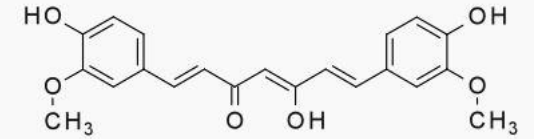
Tolerant (T), Susceptible (S) and T x S hybrid (F1) vs *Tuta absoluta*

Solanum lycopersicon



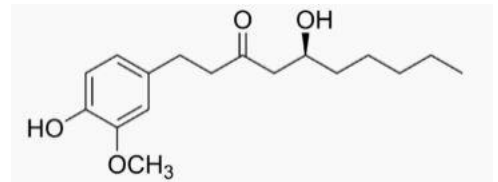
Alimenti con proprietà anti-infiammatorie

Curcuma



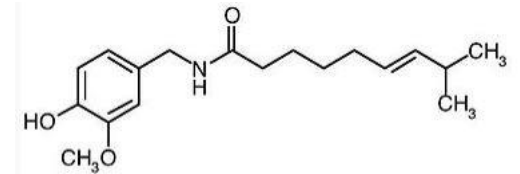
curcumina

Zenzero



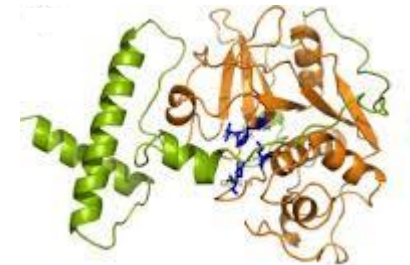
gingerolo

Peperoncino piccante



capsaicina

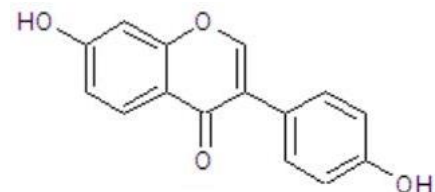
Ananas



bromelina

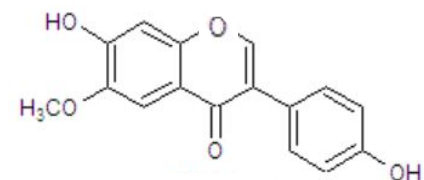
Alimenti con proprietà estrogeniche

Soia



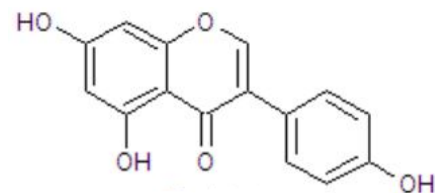
daizeina

Liquirizia



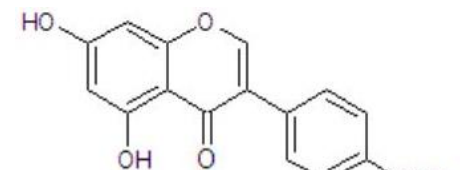
gliciteina

Luppolo



genistein

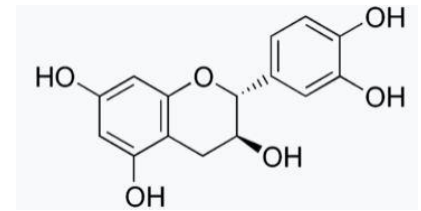
Rabarbaro



biochanin A

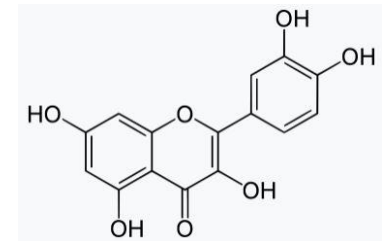
Alimenti con proprietà anti-cancro

Tea verde



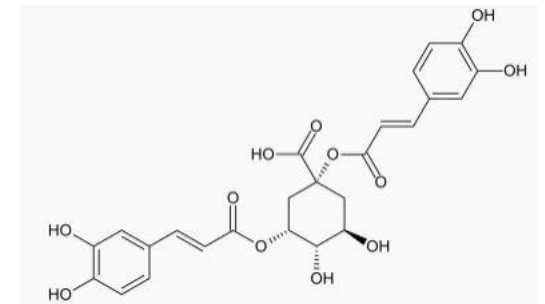
catechina

Cipolla



quercetina

Aglio



cinarina

Carciofo



References

- 1) Barile E. et al. *Org. Lett.* **2007**, 9:3603-3606; *Org. Biomol. Chem.* **2008**, 6:1756-1762.
- 2) Bonanomi G. et al. *New Phytol.* **2011**, 191, 1018-1030; *Soil Biol Biochem.* **2013**, 56:40-48.
- 3) Corea G. et al. *J. Med. Chem.* **2003**, 46:3395-3402; **2004**, 47:988-992; **2005**, 48:7055-7062.
- 4) de Falco B. & Lanzotti V. *Phytochem Rev.* **2018**, 17: 951-972; de Falco B. et al. *Food Chem.* **2018**, 254: 137-142; *Ind. Crop Prod.* **2017**, 99:86-96; **2018**, 112:584-592, *Phytochem. Anal.* **2016**, 27: 304-314; **2019**, 30:556-563.
- 5) Grauso L. et al. *Phytochem. Anal.* **2019**. 30:572-582; **2019**, 30:535-546; *Mar. Drugs* **2019**, 17,86-92.
- 6) Lanzotti V. *J. Chromatog. A* **2006**, 1112:3-22; Lanzotti V. et al. *Phytochemistry* **2012a**, 74:133-139; **2012b**, 78:126-134; *Phytochem. Rev.* **2013**, 12:12:751-772.
- 7) Osbourn A.E. , Lanzotti V. (Eds) *Plant-derived Natural Products: Synthesis, Function and Application*, **2009**, Springer, New York
- 8) Romano A. et al. *J. Nat. Prod.* **2011**



Prossimo seminario:

STEFANIA PINDOZZI

*La gestione dei reflui zootecnici e il territorio campano:
una bufala che deve girare*

10 Giugno 2020