

Chromatographic analysis at the
service of new agricultural
production systems:
chemical composition of *Chicorium
spinosum* L. with bioactive
properties

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Chromatography
helps in times of crisis
Webinar
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INTRODUCTION



The Mediterranean region is abundant with native species that have traditionally been used by locals for medicinal and therapeutic purposes over the years.

Chicorium spinosum L. (spiny chicory) is a wild edible plant – WEPs as a basic ingredient in the Mediterranean diet.

Its nutritional composition has been correlated with the prevention of chronic diseases and other health disorders.

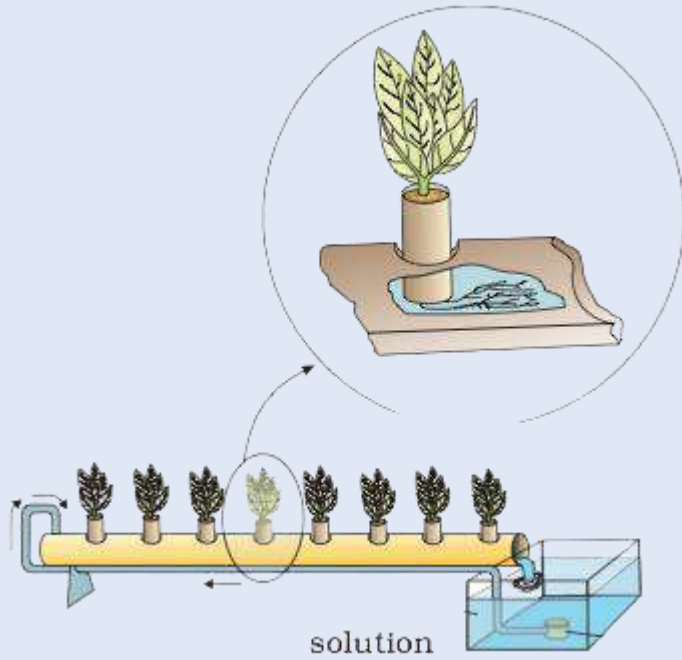
Mediterranean region



INTRODUCTION



Agricultural production using fertilizing techniques via nutrient solution



Covid-19 pandemic

All industrial sectors in adaptation



INTRODUCTION



Summary



*WEPs
with potential to
increase agronomic
systems*



*Different nutrient
solutions to valorize
functional and
bioactives compounds*



*Valorization small-
scale farms,
implementation in
agricultural systems,*

station



*How to contribute in
time of crisis?*

METHODOLOGY



100:100:100

200:100:100

200:200:200

300:100:100

Only water

300:200:200

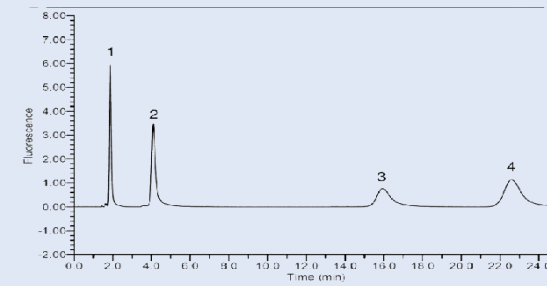
300:300:300

7 samples of *C. spinosum*

Fertilized different proportions of nitrogen, phosphorus, and potassium

Chemical composition

Organic acids (UFLC-PDA), free sugars (HPLC-RI) and fatty acids (GC-FID)



METHODOLOGY



Water at 100
°C

→ Filtration

→ Lyophilized

80:20 (v/v)
ethanol:water

→ Filtration

→ Evaporation

→ Lyophilized

Extracts^r

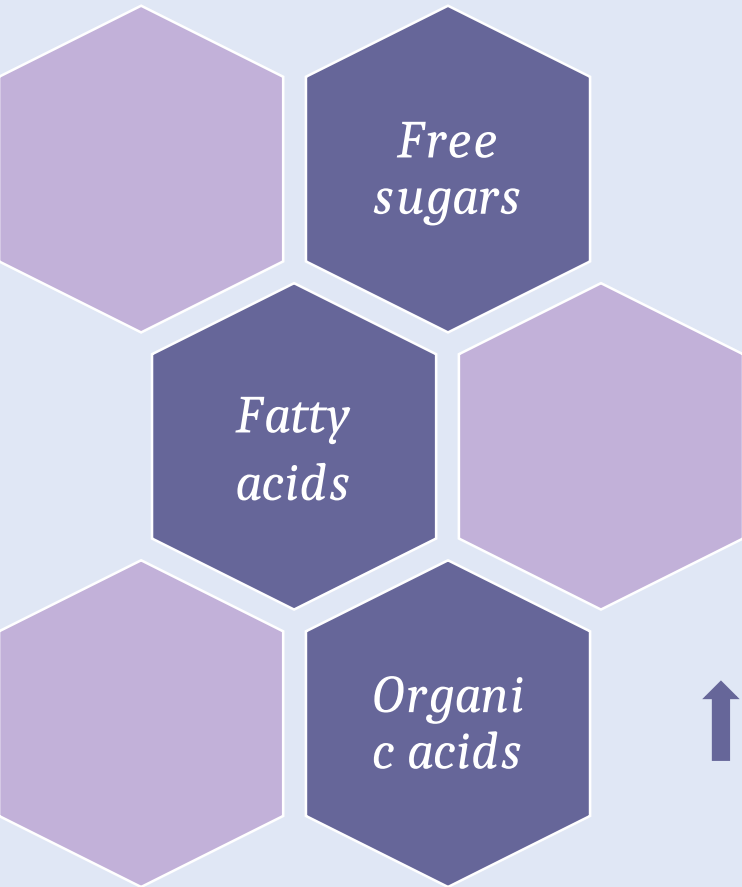
Aqueous and hydroethanolic extracts

Bioactive properties

Antioxidant, antimicrobial, anti-inflammatory and cytotoxic activities



RESULTS



Glucose > sucrose > fructose

PUFA > SFA > MUFA

↑ Quinic acid

↓ Oxalic and malic acids

300:200:200 N:P:K

Sugars and fatty acids,
mainly linolenic acid



300:100:100 N:P:K

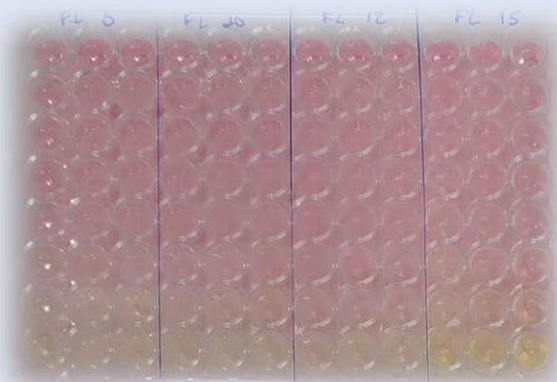
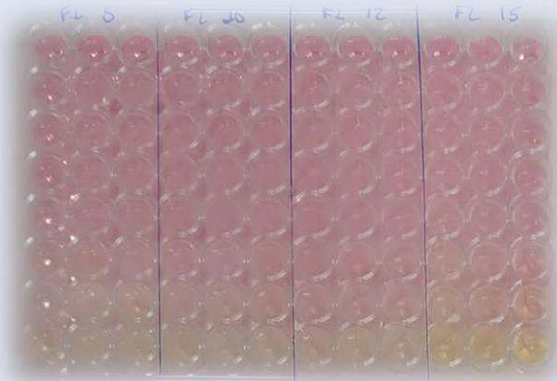
The highest amounts of
organic acids



RESULTS

Antioxidant activity

Extract	ug/mL
100:100:100 AE	143 ± 2
100:100:100 HE	411 ± 15
200:100:100 AE	167 ± 6
200:100:100 HE	408 ± 6
200:200:200 AE	116 ± 5 ↑
200:200:200 HE	363 ± 16
300:100:100 AE	225 ± 8 ↓
300:100:100 HE	151 ± 6 ↑
Control AE	357 ± 11
Control HE	479 ± 9
300:200:200 AE	163 ± 8
300:200:200 HE	465 ± 15
300:300:300 AE	159 ± 7
300:300:300 HE	547 ± 27 ↓



AE – aqueous extract
HE – hydroethanolic extract

RESULTS



Aqueous extract

Nutrient solution content of N:P:K (ppm)	<i>Aspergillus brasiliensis</i>	<i>Aspergillus fumigatus</i>
100:100:100	10	5
200:100:100	10	5
200:200:200	5	10
300:100:100	10	10
Only water (Control)	10	5
300:200:200	5	5
300:300:300	10	5

Antifungal activity



Hydroethanolic extract

Nutrient solution content of N:P:K (ppm)	<i>Aspergillus brasiliensis</i>	<i>Aspergillus fumigatus</i>
100:100:100	>10	10
200:100:100	>10	10
200:200:200	>10	10
300:100:100	>10	5
0:0:0 (Control)	>10	5
300:200:200	10	5
300:300:300	10	10

RESULTS

Antimicrobial activity

Gram-negative

Enterobacter Cloacae
Escherichia coli
Pseudomonas aeruginosa
Salmonella enterocolitica
Yersinia enterocolitica

Gram-negative

Escherichia coli
Klebsiella pneumoniae
Morganella morganii
Proteus mirabilis
Pseudomonas aeruginosa

Gram-positive

Bacillus cereus
Listeria monocytogenes
Staphylococcus aureus

Gram-positive

Enterococcus faecalis
Listeria monocytogenes
 MRSA

Clinical
bacteria

MIC	MBC
10 mg/mL	>10 mg/mL
5 mg/mL	

HE extracts (clinical)	E. Coli
200:100:100 mg/mL	0.6
300:100:100 mg/mL	0.6
200:200:200 mg/mL	1.25

Food bacteria



RESULTS



Cytotoxic

AGS **CaCo2**

MCF-7 **VERO**

>400 mg/mL

Hepatotoxic

PLP2

>400 mg/mL

Anti-inflammatory

RAW 246.7

>400 mg/mL

No cytotoxic and anti-inflammatory effects were found.



CONCLUSIONS

*The results obtained highlights the impacts of using nutrient solution in the quality of the final product, reinforcing also the potential and high added value of *C. spinosum* plant.*

REFERENCES

- 1. S. A. Petropoulos, Â. Fernandes, V. Antoniadis, G. Ntatsi, L. Barros, and I. C. F. R. Ferreira. Food Chem., vol. 239 (2018) 946–952.*
- 2. S. Petropoulos, Â. Fernandes, A. Karkanis, V. Antoniadis, L. Barros, and I. C. F. R. Ferreira. Sci. Hortic. (Amsterdam)., vol. 231 (2018), 97–107.*



THANK YOU FOR ATTENTION!

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