Biologically active compounds from plants as natural food preservatives

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Summer school "Safety in the Food Chain"

Prague 2015

Infectious diseases

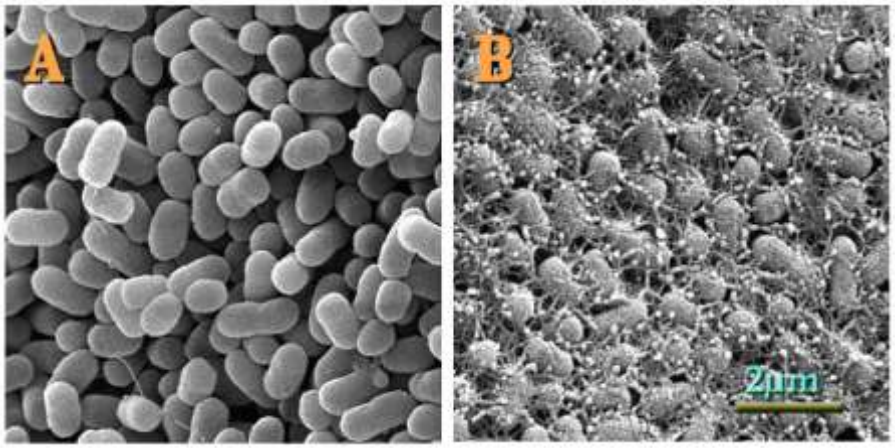
	Cause of death	Deaths 2002	% of all deaths	Deaths 1993
	All infectious diseases	14.7 mil.	25.9%	16.4 mil.
1	Lower respiratory infections	3.9 mil.	6.9%	4.1 mil.
2	HIV/AIDS	2.8 mil.	4.9%	0.7 mil.
3	Diarrheal diseases	1.8 mil.	3.2%	3.0 mil.
4	Tuberculosis	1.6 mil.	2.7%	2.7 mil.
5	Malaria	1.3 mil.	2.2%	2.0 mil.
6	Measles	0.6 mil.	1.1%	1.1 mil.
7	Pertussis	0.29 mil.	0.5%	0.36 mil.
8	Tetanus	0.21 mil.	0.4%	0.15 mil.
9	Meningitis	0.17 mil.	0.3%	0.25 mil.
10	Syfilis	0.16 mil.	0.3%	0.19 mil.
11	Hepatitis B	0.10 mil.	0.2%	0.93 mil.

Bacteria - history

- 1676 - van Leeuwenhoek microscope
- 1905 – Nobel Prize Robert Koch
  - Koch's postulates
- 2005 – Nobel Prize Warren a Marshall
  - *Helicobacter pylori*

Bacteria

- Adult human
  - 100 000 000 000 000 (10^{14}) our own cells
  - 100 000 000 000 000 (10^{14}) bacterial cells **in** our body
  - 1 000 000 000 000 (10^{12}) bacterial cells **on** our body
  - 10^{115} scrabble combinations
  - 10 cells E. coli O157:H7



New antimicrobials in food and agriculture???

- Risk of infection
  - Consumers fear

doi: 10.1111/j.1365-2222.2009.03362.x

Clinical & Experimental Allergy, **39**, 1643–1651

REVIEW

Clinical effects of sulphite additives

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Clinical & Experimental Allergy

Summary

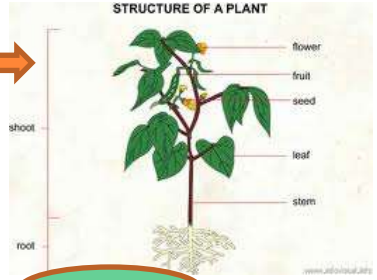
Sulphites are widely used as preservative and antioxidant additives in the food and pharmaceutical industries. Topical, oral or parenteral exposure to sulphites has been reported to induce a range of adverse clinical effects in sensitive individuals, ranging from dermatitis, urticaria, flushing, hypotension, abdominal pain and diarrhoea to life-threatening anaphylactic and asthmatic reactions. Exposure to the sulphites arises mainly from the

Plant based compounds

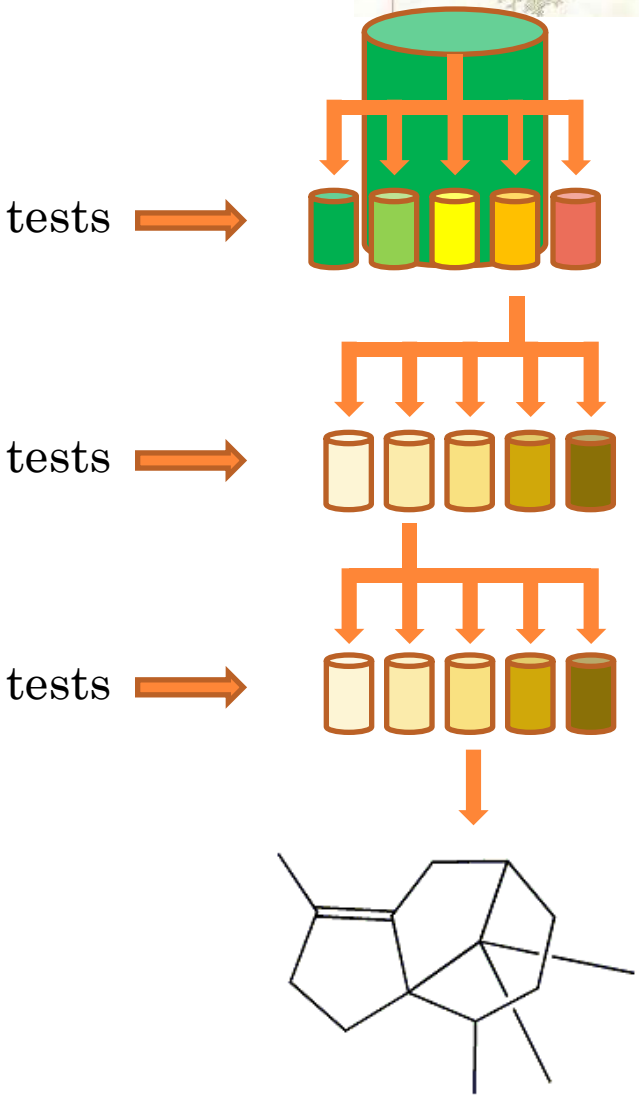
- Major part of carbon bound in primary metabolites
- Among 300 000 higher plants – only 5% chemically investigated
- 150 000 compounds
- Adaptation to environmental factors

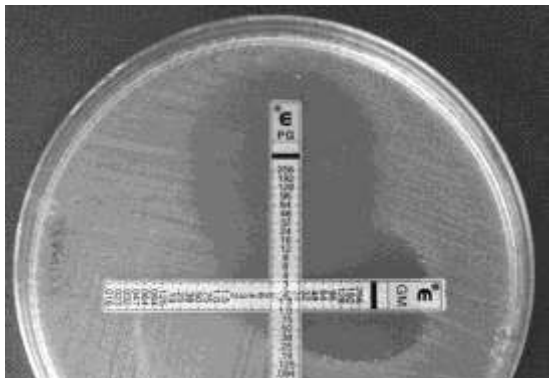
BUT HOW TO FIND THIS PLANT???

HOW TO FIND ACTIVE COMPOUND

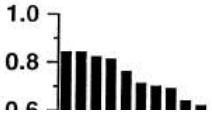


- Screening of crude extracts
- Bioassay guided fractionation
  - Single compound
- Synergy
- 1+1=2 Additive
- 1+1=5 Synergy





SPICES



(b) India

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THE QUARTERLY REVIEW of BIOLOGY

ANTIMICROBIAL FUNCTIONS OF SPICES: WHY SOME LIKE IT HOT

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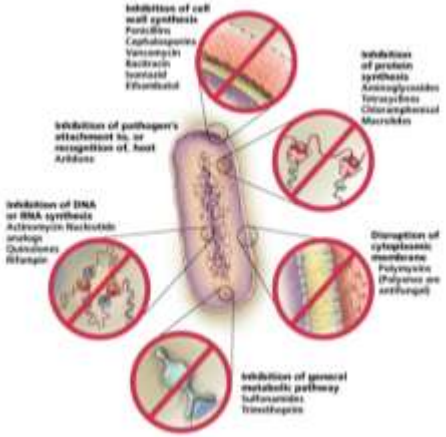
- ESSENTIAL OILS

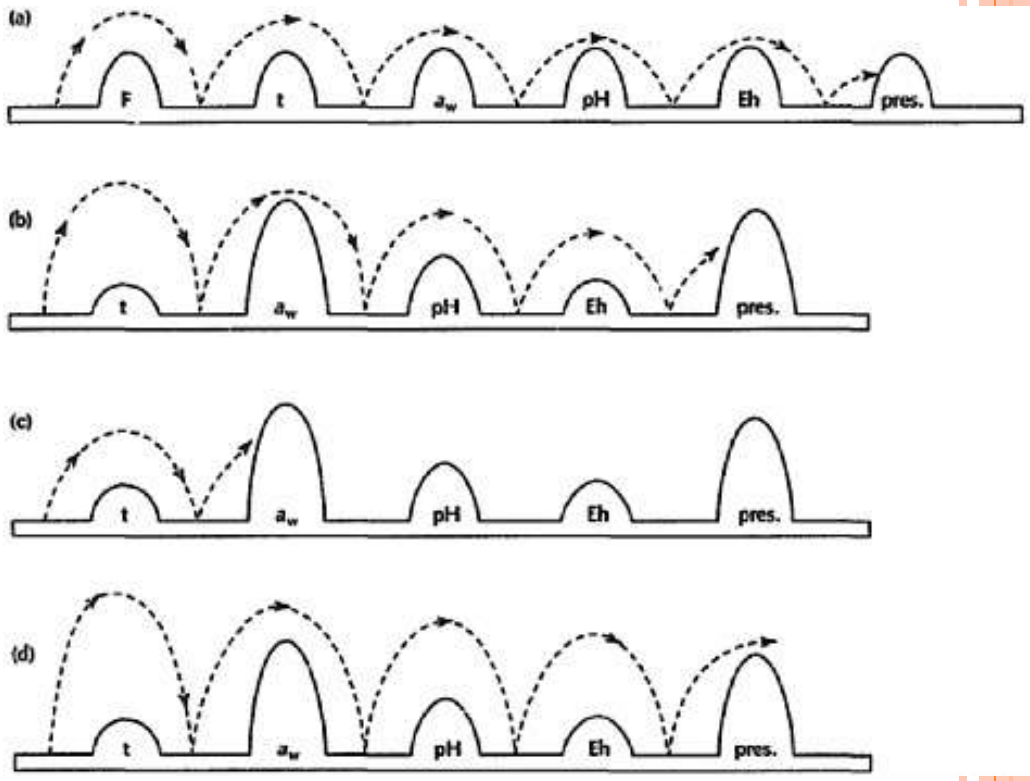
Strategies for food – Direct addition

- Antibiotics MIC 0,01 – 10 µg/ml
- Most plant antimicrobials high MIC
  - MIC 100 – 1000 µg/ml
  - 150 compounds MIC < 64 µg/ml
  - Some < 1 µg/ml
    - Diallyltetrasulfid from garlic



Strategies for food – Hurdle principle

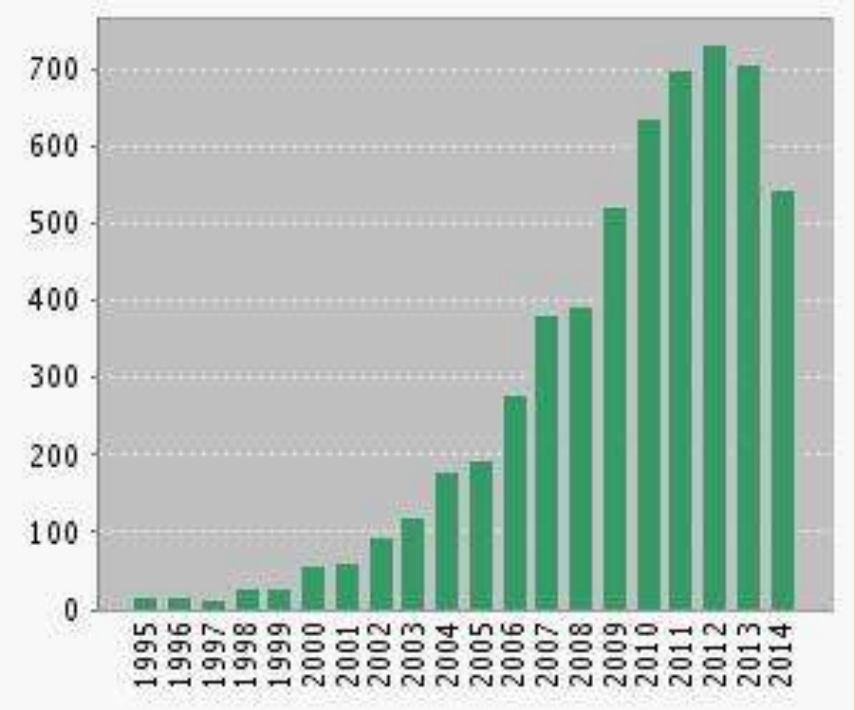
- Combination of different techniques
  - Water activity
  - pH
  - Temperature
  - Modified atmosphere
- Together with plant base preservatives
  - Lower doses
  - Lower adverse effects



Lot of research….

- **6000 papers*** on antimicrobial activity of EOs so far (WOS)
- First paper **1945**

  (Cavallito et al.) – allicin



*Search string: "essential oil" and (antibacterial or antifungal or antimicrobial)

Cavallito ,C.J., Bailey, J.H., Buck, J,S. (1945). The antibacterial principle of allium-sativum 3. Its precursor and essential oil of garlic. Journal Of The American Chemical Society, 67(6): 1032-33

Science vs. Practice

- ”ethno-technology” examples
- hanging horseradish root in wine cask –Moravian wine cellars (personal commun.)
- meat wrapped in horseradish leaf (my grandmother, not published)
- virtually every culture (spices, burning, aromatherapy)

Contents lists available at ScienceDirect

Industrial Crops and Products

journal homepage: www.elsevier.com/locate/indcrop

Short communication

Long-term antifungal activity of volatile essential oil components released from mesoporous silica materials

Anezka Janatova[a,b], Andrea Bernardos[a], Jakub Smid[a], Adela Frankova[a], Miloslav Lhotka[c], Lenka Kourimská[b], Josef Pulkrabek[a], Pavel Kloucek[b,*]

Contents lists available at ScienceDirect

Food Control

journal homepage: www.elsevier.com/locate/foodcont

Antimicrobial properties of selected essential oils in vapour phase against foodborne bacteria

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Thank for attention!!!

- And remember…