



# Applied insect ecology 2017 – 5

## Biopesticides // Biological pesticides

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# Insecticides

- Pesticidy



## Pesticides - taxon

- insecticides
- acaricides (miticides)
- rodenticides
- molluscocides
- nematocides
  
- herbicides
  
- fungicides
  
- antimicrobials



# Insecticides

- Pesticidy

## Pesticides - stage

- ovicides
- larvicides
- adulticides
- sterilants

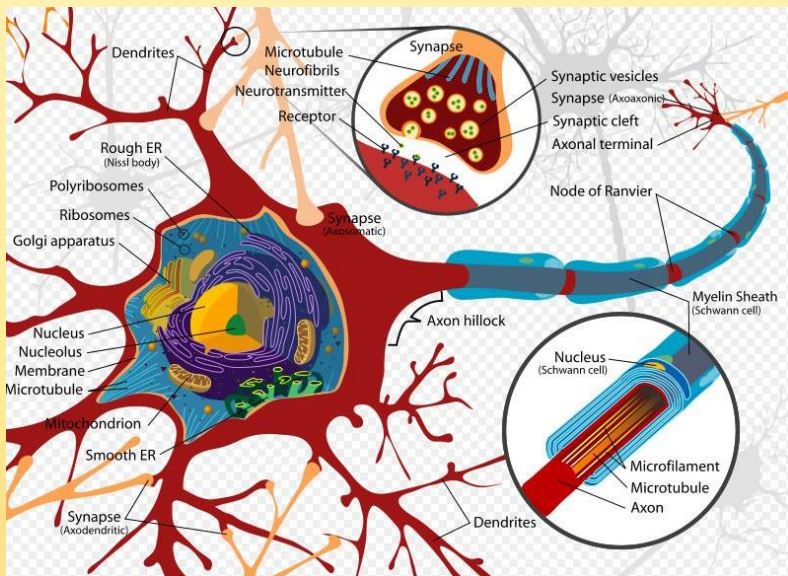


# Insecticides

- Pesticidy

## Pesticides - physiology

- neurotoxins
- metabolic toxins
- development disruptors



# Insecticides

- Pesticidy

## Pesticides - chemistry

- inorganic compounds
- oils (petroleum)
- organophosphates
- carbamates
- organochlorines
- pyrethroids
- dinitrophenols
- organotin
- ...
- ...



# Insecticides

## • Pesticidy

- postřik
  - roztok
  - emulze
  - olejová emulze
- popraš
- fumigace (plynování)
- impregnace dřeva
- plnidla
  
- kontaktní
- požerový
- systemický



## Pesticides - formulation

- spray
  - water solution
  - water emulsion
  - oil emulsion
- dust
- fumigation
- wood protection
- inert ingredients

## Way of ingestion


- contact
- food
- systemic



# Insecticides

- Pesticidy

**Warning - Pesticides In Use**  
All contact with the portion of the treated property upon which the pesticide application has taken place must be avoided.



Pesticide PCP#: \_\_\_\_\_  
Common Name: \_\_\_\_\_  
Trade Name: \_\_\_\_\_  
Date Used: \_\_\_\_\_  
Contact Phone#: \_\_\_\_\_  
Company Name: \_\_\_\_\_  
(If commercially applied)

## Resistance

- range of use
- doses
- refugia for sensitive individuals
- late-acting insecticides  
fungal pesticides against malaria



# Insecticides

- Pesticidy

- bezpečnost
- <http://www.irz.cz/latky/>

## Pesticides safety

- research
- toxicity tests
- environmental assesment
- applicator training  
<http://web.extension.illinois.edu/privatepsep/>
- Acceptable Daily Intake



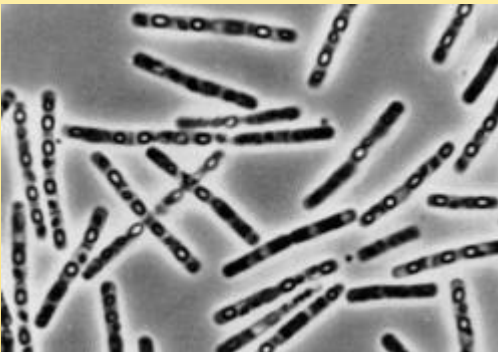


# Insecticides

- Pesticidy

## Biorational insecticides

- microbial
  - viruses, bacteria, fungi, protozoa, and nematodes
- plant-Incorporated protectants (PIPs) = GMO = transgenic plants
- plant extracts
- Hormones
- growth regulators
- Pheromones



# Insecticides

- Pesticidy

## Pesticide history

- Homer (1000 B.C.)  
burning sulfur
- Pliny the Elder (A.D. 23-79): *Natural History*
- extracts of pepper and tobacco, soapy water, whitewash, vinegar, turpentine, fish oil, brine, lye
- arsenicals, petroleum oils, nicotine, pyrethrum, rotenone, sulfur, hydrogen cyanide gas, cryolite
- synthetic organic insecticides, the first of which was DDT



# Insecticides

- Pesticidy

## Botanicals

- pyrethrin
- nicotin
- rotenon
- limonene
- Azadirachtin
- capsaicin

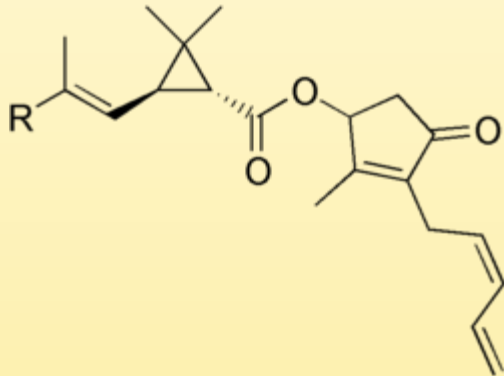
## Antibiotics

- avermectin



# Botanical insecticides

- Pesticidy



## Pyrethroids

- natural pyrethrin
  - instability in sunlight
  - Chrysanthemum (Pyrethrum)*  
*cinerariaefolium*
  - Hermann Staudinger and Lavoslav Ružička  
in 1924
  - extract (spray)
  - dust
  - fogging
  - low mammal toxicity: lethargy, muscle  
tremors, vomiting, headache, nausea
- synthetic pyrethroids
  - stable
  - low doses: 0.01 to 0.1 pound per acre
  - 10-100 g / ha



# Botanical insecticides

- Pesticidy

## Pyrethrin

- *Chrysanthemum (Pyrethrum) cinerariaefolium*
- origin: Dalmatia
- production: Kenya, Tanzania, Ecuador, 7000 t
- poison, repellent
- companion planting



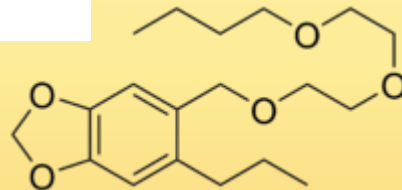
# Botanical insecticides

- Pesticidy



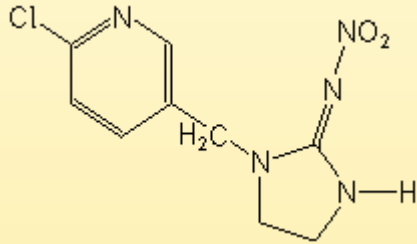
## Pyrethroids

- mode of action
  - prolonged openings of sodium channels
  - membrane depolarization
  - repetitive discharges
  - hyperexcitatory symptom
  - paralysis, knock-down
- selective toxicity
  - responses of sodium channels
  - metabolic degradation
- temperature coefficient
  - type I negative
  - type II positive
- synergistic action
  - piperonylbutoxide
  - cytochrome P450 and non-specific esterase inhibitor



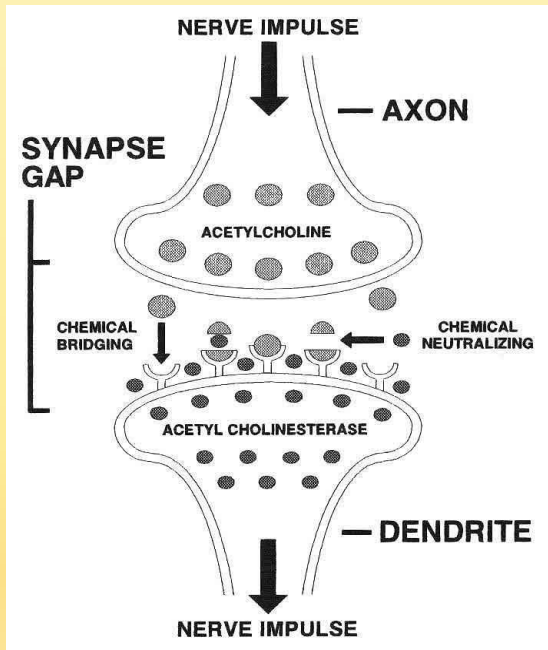
# Botanical insecticides

- Pesticidy

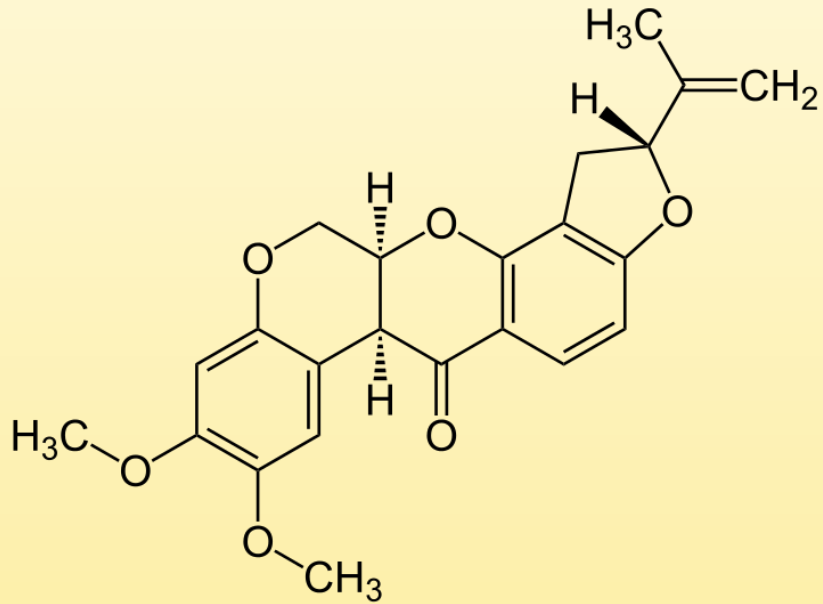


## Nicotinoids

- nitro-quanidines, neonicotinyls, neonicotinoids, chloronicotines, chloronicotinyls
  - imidacloprid in 1990
    - systemic
    - no effect on mites
  - acetamiprid (Assail®)
  - thiamethoxam (Actara®, Platinum®)
  - nitenpyram (Bestguard®)
  - clothianidin (Poncho®)
  - dinotefuran (Starke®)
  - thiacloprid
- mode of action
  - central nervous system of insects
  - irreversible blockage of postsynaptic nicotinic acetylcholine receptors



# Botanical insecticides



- Rotenone

- Insecticide
- Piscicide
- Parkinson disease
- *Lonchocarpus nicou*
- *Derris elliptica*
- Electron transport in mitochondria

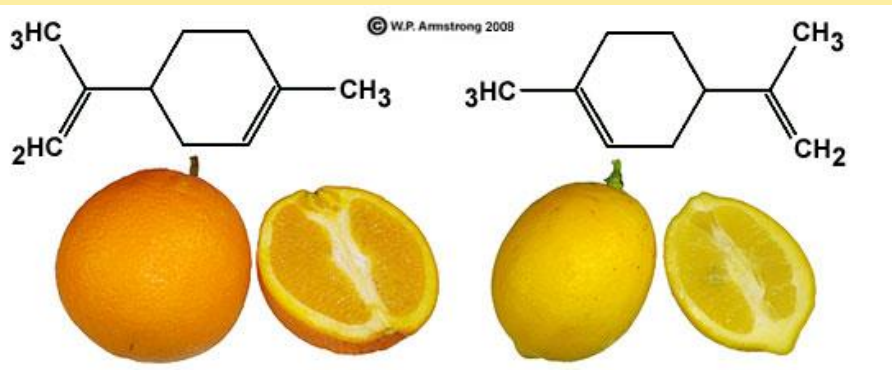




# Botanical insecticides

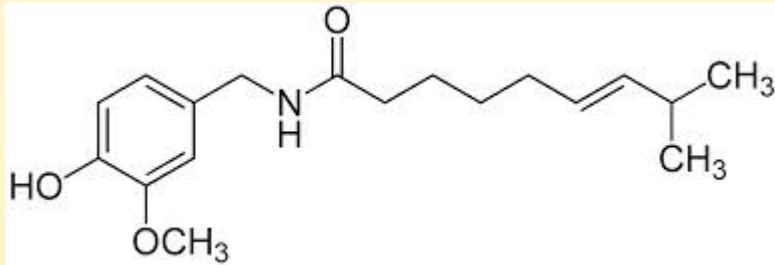
- Limonen

- Insecticide
- Parfumery
- Food
- Cleaning (solvent)
- Flamable
- Ectoparasites
- Attractive to predators (plant call for help)





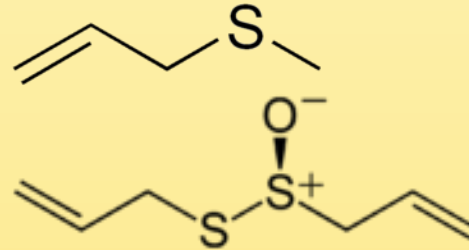
# Botanical insecticides



- Capsaicin
  - Repellent
  - Ornamentals

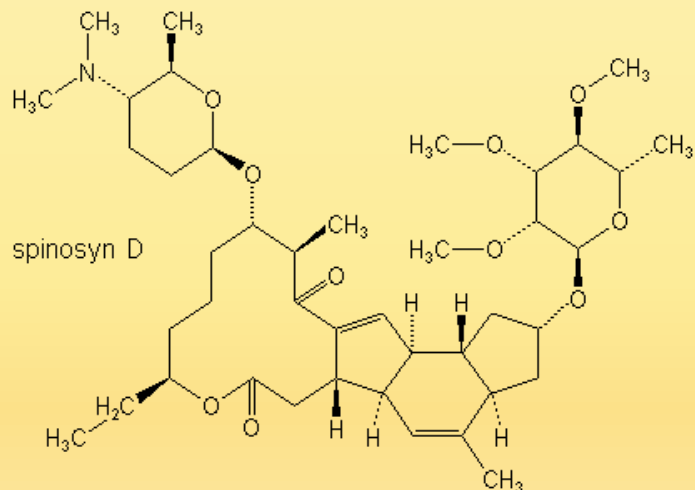
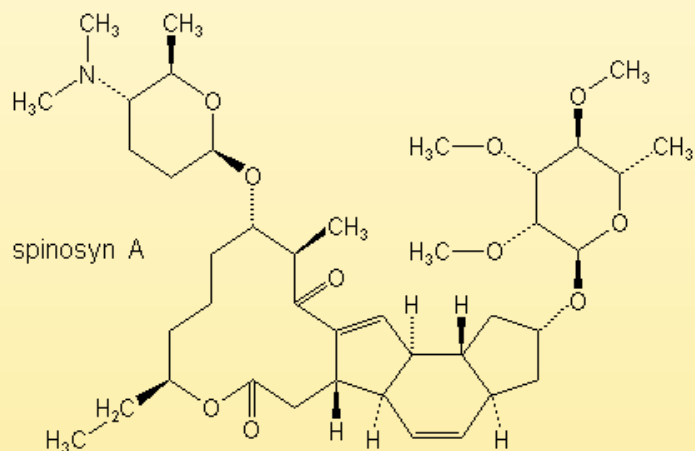


- Allicin, allylmethylsulphide (garlic)
  - Insecticide
  - Nematocide



# Insecticides

- Pesticidy



## Spinosyns

spinosad (Success®, Tracer Naturalyte®)  
actinomycete *Saccharopolyspora spinosa*  
0.04 to 0.09 pound of active ingredient (18  
to 40 grams) per acre

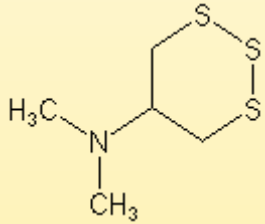
- mode of action

disrupting binding of acetylcholine in  
nicotinic acetylcholine receptors



# Insecticides

- Pesticidy



## Nereistoxin analogues

thiocyclam (Evisect®)

thiocyap-sodium

thiosultap-sodium (Pilarhope®)

cartap (Agrotap®)

bensultap (Bancol®)

stomach poisons

activation in target

selectively active on Coleoptera,  
Lepidoptera

- mode of action

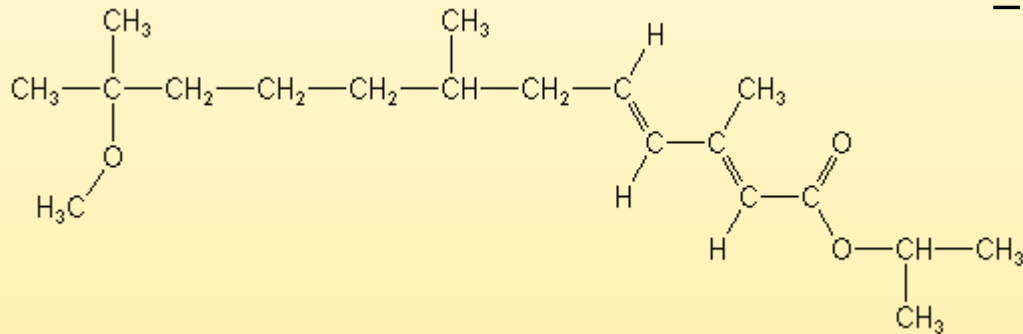
acetyl choline receptor agonists at low  
concentration

channel blockers at higher concentrations



# Insecticides

- Pesticidy



## Hormones

- juvenile hormone analogues

methoprene (Altosid®)

UOChB – *Monomorium*

hydroprene (Gentrol® , Mator® )

kinoprene (Enstar II® )



# New plant extracts

	<b>LD<sub>50</sub> (CI<sub>95</sub>)<sup>a</sup> (mg/g)</b>
<i>Ailanthus altissima</i>	4.8 (3.8-5.3)
<i>Ajuga chamaepitys</i>	9.9 (8.9-10.3)
<i>Ajuga reptans</i>	3.7 (3.0-4.4)
<i>Angelica archangelica</i>	0.4 (0.3-0.5)
<i>Artemisia campestris</i>	7.4 (5.5-11.8)
<i>Buphtalmum salicifolium</i>	8.7 (6.9-12.9)
<i>Camellia sinensis</i>	2.6 (1.8-3.3)
<i>Chenopodium bonus-henricus</i>	8.9 (8.1-9.9)
<i>Eupatorium cannabinum</i>	10.2 (9.8-11.3)
<i>Foeniculum vulgare</i>	9.3 (7.9-10.5)
<i>Lythrum salicaria</i>	2.3 (1.3-2.9)
<i>Lythrum virgatum</i>	6.1 (4.3-8.9)
<i>Mentha arvensis</i>	3.5 (3.1-4.8)
<i>Mentha longifolia</i>	4.5 (3.3-6.5)
<i>Mentha suaveolens</i>	7.3 (6.3-8.5)
<i>Potentilla argentea</i>	3.6 (3.0-4.2)
<i>Potentilla fruticosa</i>	5.8 (4.3-7.2)
<i>Seseli pallasii</i>	8.6 (6.9-9.9)
<i>Vincetoxicum hirundinaria</i>	6.0 (4.8-7.8)

- Plant protection institute
- Roman Pavela
  - [http://www.academicjournals.org/article/article1380968056\\_Pavela.pdf](http://www.academicjournals.org/article/article1380968056_Pavela.pdf)

