



# Aplikovaná ekologie hmyzu 2014 – 7 biopesticidy // biological pesticides

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Entomologický ústav BC AV ČR



# Insecticides

- Pesticidy



- Pesticides - taxon

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



# Insecticides

- Pesticidy

- Pesticides - stage

- ovicides
- larvicides
- adulticides
- sterilants



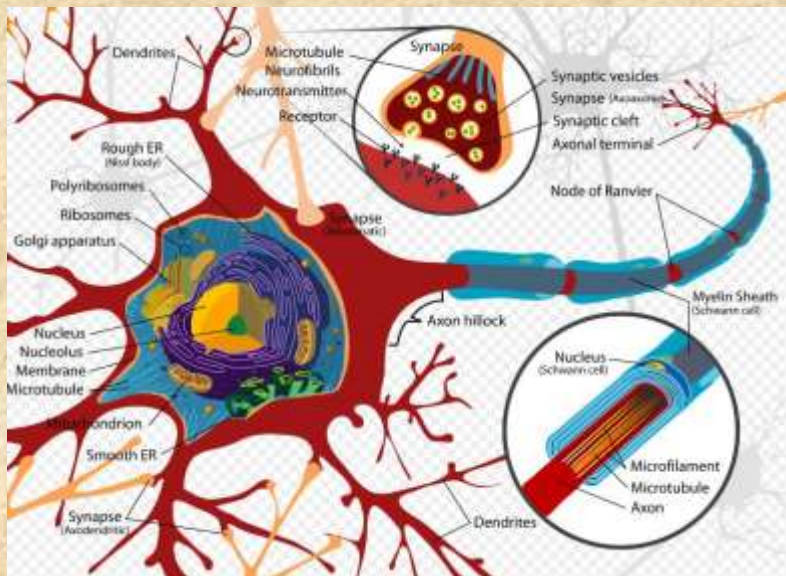


# Insecticides

- Pesticidy

- Pesticides - physiology

- neurotoxins
- metabolic toxins
- development disruptors



# Insecticides

- Pesticidy

- Pesticides - chemistry

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



# 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
  
- 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/privateps ep/>
- Acceptable Daily Intake



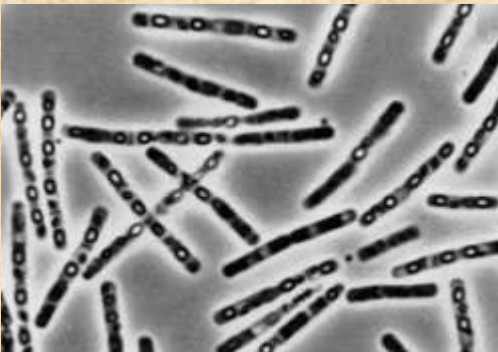


# Insecticides

- 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

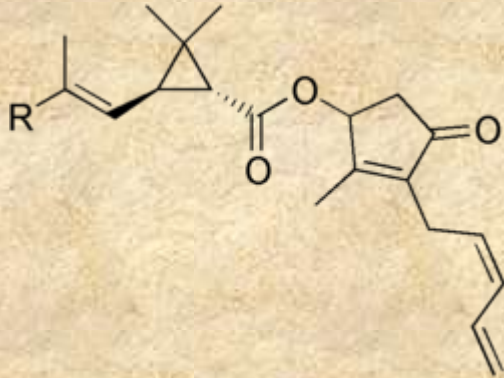
- avermectin





# 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





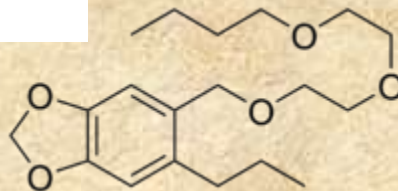
# Botanical insecticides

- Pesticidy



- Pyrethroids

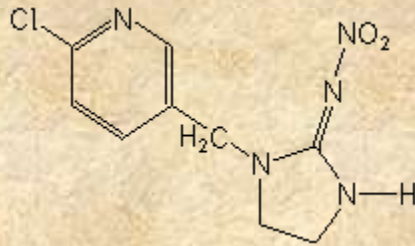
- mode of action
  - prolonged openings of sodium channels
  - membrane depolarization
  - repetitive discharges
  - hyperexcitatory symptom
  - paralysis, knock-down
- selective toxicity
  - responses of sodium channels
  - metabolic degradation
- temperature coefficient
  - type I negative
  - type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





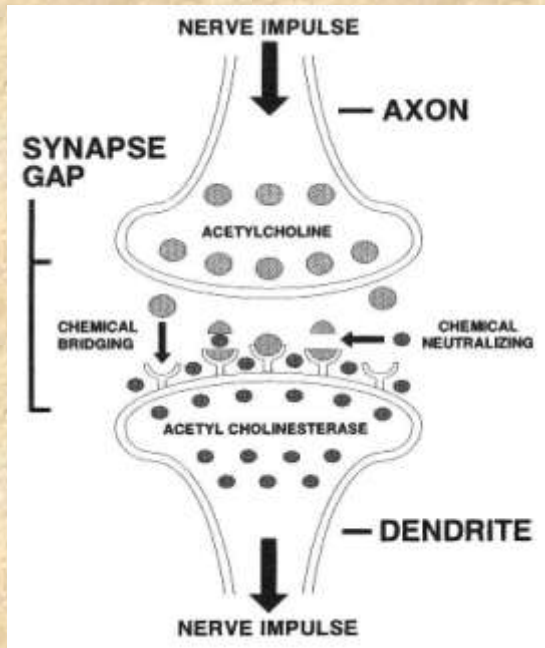
# Botanical insecticides

- Pesticidy

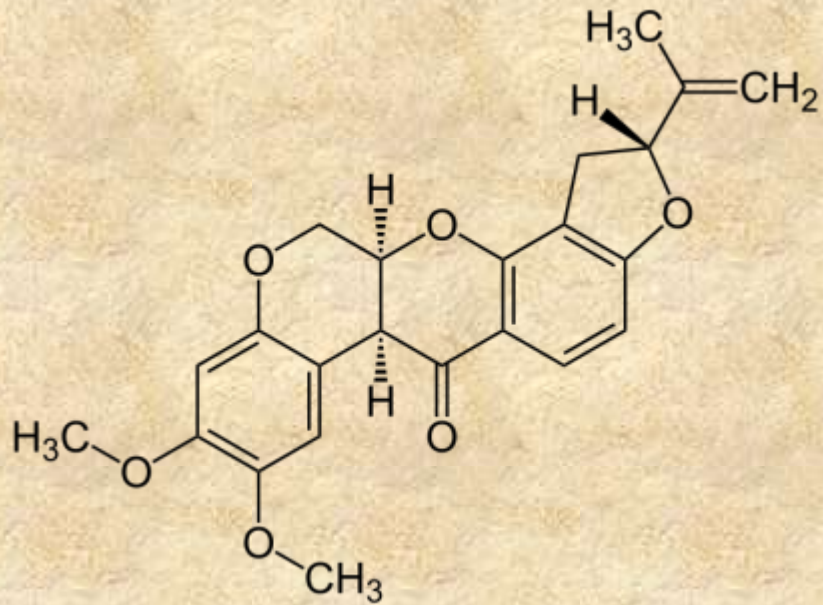


- Nicotinoids

- 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



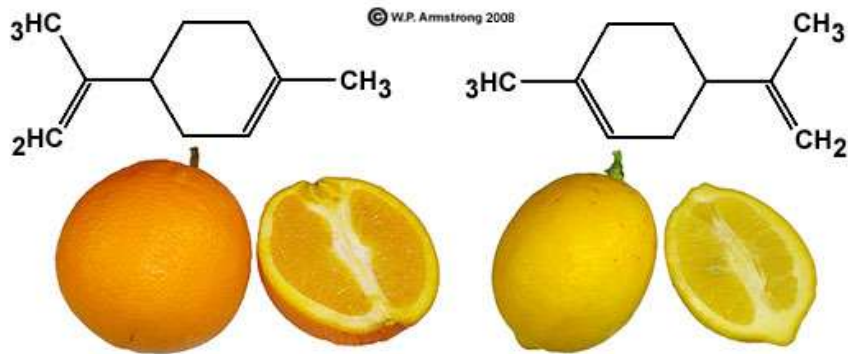
- Rotenone

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



# Botanical insecticides

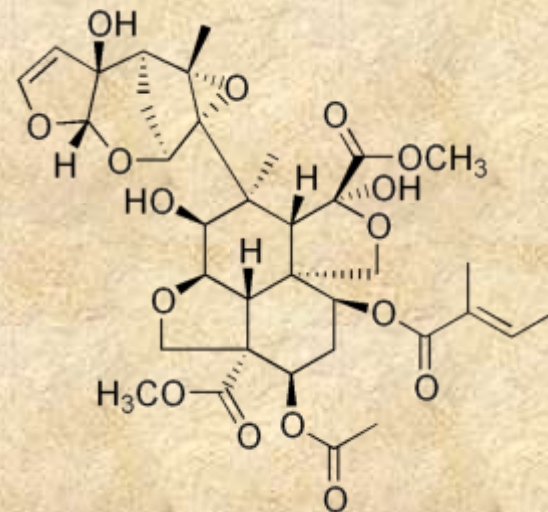
- Limonen
  - Insecticide
  - Parfumery
  - Food
  - Cleaning (solvent)
  - Flamable
  - Ectoparasites
  - Attractive to predators



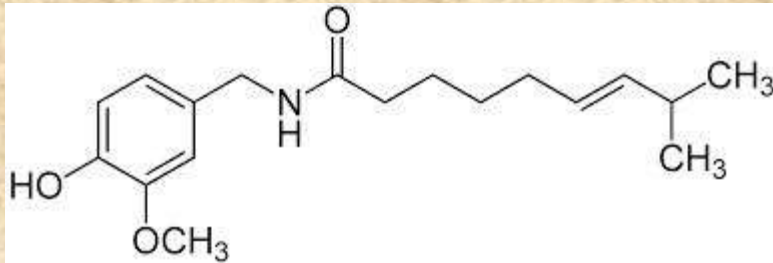


# Botanical insecticides

- Azadirachtin
  - Neem seed
  - Feeding deterrent
  - *Schistocerca gregaria*
  - Growth regulator
  - Immature stages
  - Fungicide



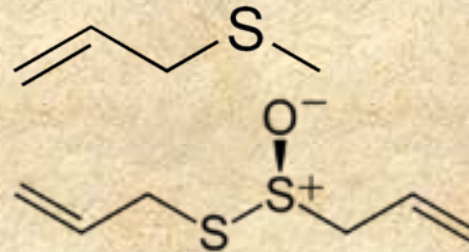
# Botanical insecticides



- Capsaicin
  - Repellent
  - Ornamentals



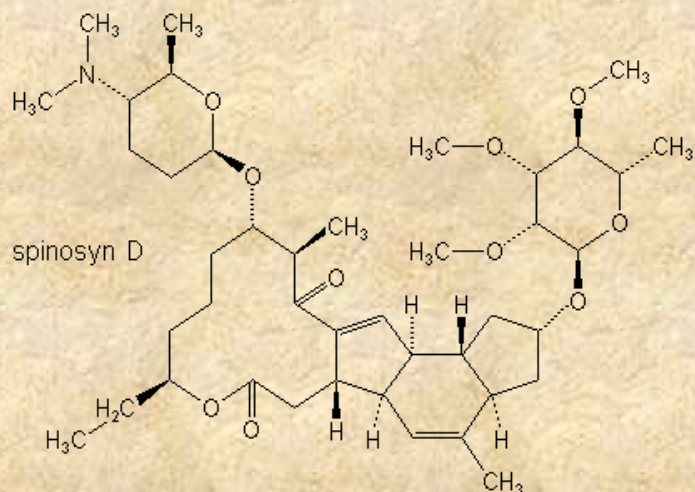
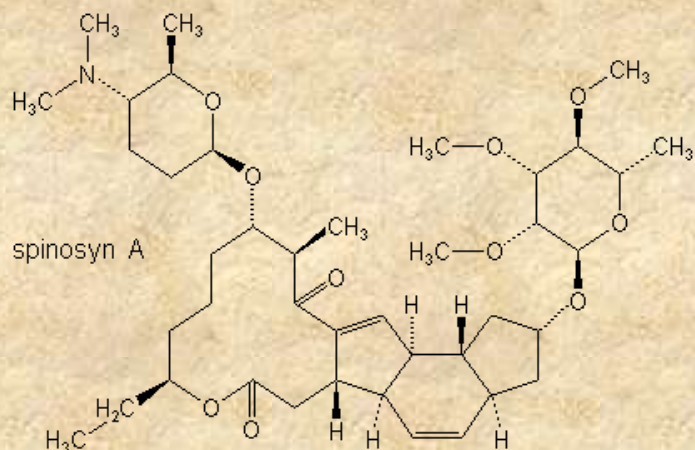
- Allicin, allylmethylsulphide (garlic)
  - Insecticide
  - Nematocide





# Insecticides

- Pesticidy



- Spinosyns

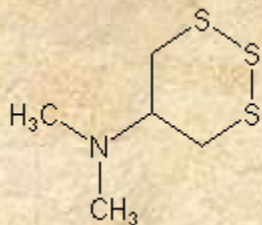
- spinosad (Success®, Tracer Naturalyte®)
- actinomycete *Saccharopolyspora spinosa*
- 0.04 to 0.09 pound of active ingredient (18 to 40 grams) per acre
- mode of action
  - disrupting binding of acetylcholine in nicotinic acetylcholine receptors





# Insecticides

- Pesticidy



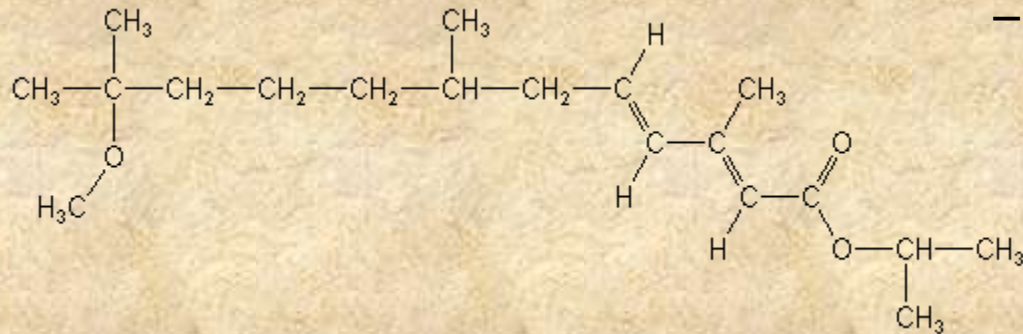
- Nereistoxin analogues

- thiocyclam (Evisect®)
  - thiocytap-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

|                                   | LD <sub>50</sub> (CI <sub>95</sub> ) <sup>a</sup> (mg/g) |
|-----------------------------------|--|
| <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)

