



Applied insect ecology 2017 – 5

Biopesticides // Biological pesticides

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a

oddělení ekofyziologie

Entomologický ústav BC AV ČR



Semiochemicals

- Informační látky

- řecky σμῆνον (semeon) = signál
- vnitrodruhové = feromony
- mezidruhové = alelochemikálie



Infochemicals

- mediating information
- greek word σμῆνον (semeon)=signal
- interspecific = allelochemicals
- intraspecific = pheromones



Semiochemicals

- Informace

- alomony
- kairomony
- synomony

Information

- allomonas = emitter +, receiver –
- kairomonas = emitter –, receiver +
- synomonas = emitter +, receiver +



Semiochemicals

• Informace

- arestanty (let)
- atraktanty
- repelenty
- antifídanty
- stimulanty

Function

- arrestants (flight)
- attractants
- repellents
- deterrents (antifeedants)
- stimulants (feeding)



Semiochemicals

- Feromony

- řecky φηρευμ (phereum) = nést;
χορμαν (horman) = působit
- alarmující
- agregační
- stopovací
- pohlavní

Pheromones

- greek φηρευμ (phereum) = to carry;
χορμαν (horman) = to stimulate;
- alarm
- aggregation
- food trail
- sex



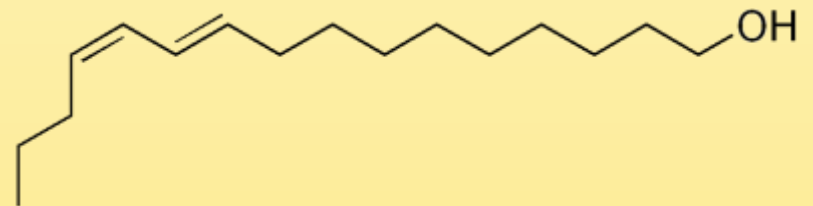
Semiochemicals

- Feromony

- bourec morušový (*Bombyx mori*)

Pheromones

- isolation and identification of the first insect pheromone
- silkworm moth: 1959



Semiochemicals

- pohlavní feromony

Sexual pheromones

- usually female
- volatile
- long distance attractants
- courtship ph.



Semiochemicals

- pohlavní feromony

Sexual pheromones

- alcohols, alkanes, aldehydes, esters
- multicomponent
- species specific mixture
different distance
reproduction isolation



Semiochemicals

- pohlavní feromony
 - sledování škůdců
 - past s nástrahou
 - ničení škůdců
 - pasti
 - dezorientace



Sexual pheromones

- pest monitoring (detection, signalisation)
 - timing, abundance
 - baited trap, sticky trap, closed trap
- pest control
 - destruction: lure and kill
 - mass trapping: baited traps 95-99%
 - mating disruption: disinformation, disorientation



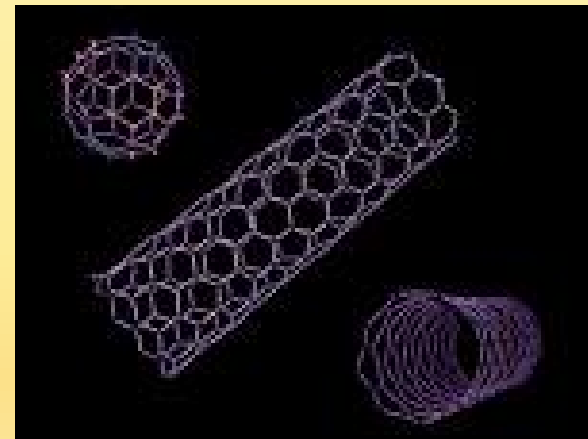
Semiochemicals

- pohlavní feromony

- dezorientace
- práh vnímání

Sexual pheromones

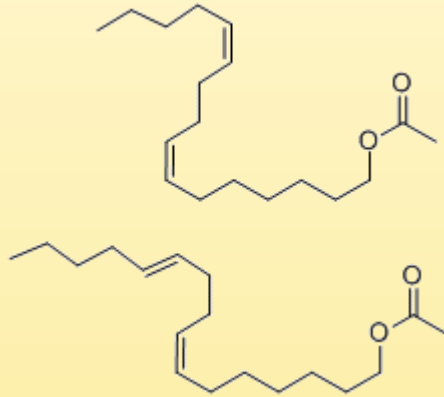
- disorientation, communication (mating) disruption, male confusion
- threshold hypothesis for pheromone perception
- pheromone dispenser
- hollow nanofibres
 - polyamide, cellulose acetate, 33% ph.
- nanotubes



Semiochemicals

- pohlavní feromony

- obaleč bavlníkový



Pinkspotted bollworm moths and larvae Photo: P. Room (CSIRO)

Sexual pheromones

- pink bollworm, *Pectinophora gossypiella*
- gossypure = mixture of Z, Z- and Z, E-7,11-hexadecadienyl acetate
- in traps in Arizona
- >95% trapped
- untrapped males mate more frequently
- mate disruption 1978
- 7-28 days
- hundreds and thousands per hectare



Semiochemicals

- zmatení samců
 - obaleč bavlníkový

mating disruption

- false trail following
- hollow fibres
- 0.75 to 1.5 g AI/acre repeatedly
- small amounts of a contact insecticide
- dead male is better than a confused one
- confusion
- larger doses 30 g once
- habituated receptor cells



Semiochemicals

- zmatení samců
 - květostas bavlníkový



mating disruption

- boll weevil eradication program
- *Anthonomus grandis*
- male sex pheromone
- aggregating pheromone
- grandlure = 4 components
- 2 million traps and 25 million trap baits in 1995
- malathion sprays



Semiochemicals

- zmatení samců
 - lýkožrout smrkový

mating disruption

- spruce bark beetles
- *Ips typographus*
- 3 component aggregation pheromone
- 1580 mg of active ingredients with a service life of about 2 months in plastic bag
- box traps
- standing trap trees
- insecticide-sprayed logs
- removed parasites and predators
- 1980 in Norway 4.5 billion beetles



Semiochemicals

- pohlavní feromony
 - lýkožrout
 - lapače 400 Kč
 - lapáky

Sexual pheromones

- bark beetle



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Aplikovaná ekologie hmyzu



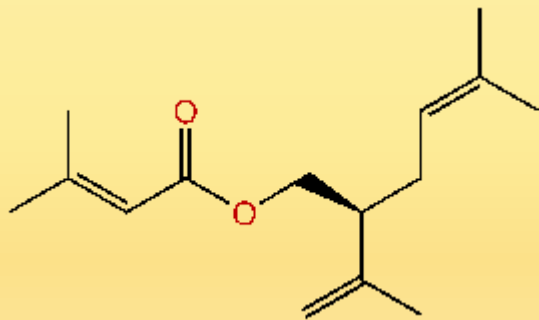
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Semiochemicals

- pohlavní feromony
 - červec

Sexual pheromones

- Vine mealybug (*Planococcus ficus*)
- lavandulyl senecioate
- mating disruption



Semiochemicals

- pohlavní feromony

- obaleč
- obaleč jablečný
- obaleč mramorovaný

Sexual pheromones

- cherry bark tortrix, *Enarmonia formosana* (Scopoli)(Lepidoptera: Tortricidae)
- Codling moth *Laspeyresia pomonella* L. (Lepidoptera, Tortricidae)
- *Sparganothis pilleriana* and *Lobesia botrana* in vineyards



Semiochemicals

- pohlavní feromony
 - obaleč jablečný



Sexual pheromones

- Codling moth *Laspeyresia (Cydia) pomonella* L. (Lepidoptera, Tortricidae)
- Codlemone: (E,E)-8,10-Dodecadien-1-ol



Semiochemicals

- pohlavní feromony

- klíněnka jírovcová, Gracillariidae -
vzpřímenkovití

Sexual pheromones

- horse chestnut leafminer *Cameraria
ohridella*



(E,Z)-8,10-Tetradecadienal



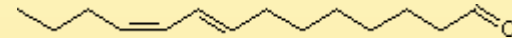
Semiochemicals

- pohlavní feromony

- klíněnka jírovcová, Gracillariidae - vzpřímenkovití
- kontrola člověkem
 - postřiky v době páření
 - lepicí lapače s feromony
 - sexuální feromon se podařilo izolovat a identifikovat v pražském Ústavu organické chemie a biochemie AV ČR (ÚOChB)
 - projekt CONTROCAM
 - vychytání samců
 - dezorientace samců
 - indikace počtu jedinců, časování generací
 - vůně hostitelské rostliny
 - shrabání a pečlivý úklid spadaneho listí
- zmírnit negativní pohled na klíněnku jako na škůdce našeho národního bohatství; jírovec je koneckonců v naší přírodě cizincem, který se nemůže divit, když ho jiný cizinec ožírá

Sexual pheromones

- horse chestnut leafminer *Cameraria ohridella*



(E,Z)-8,10-Tetradecadienal



Semiochemicals

- Feromony
 - agregující

Aggregation pheromones

- defense against predators
- mate selection
 - male sex ph. attracts both sexes
- overcoming host resistance by mass attack
- Coleoptera, Dictyoptera, Hemiptera, Homoptera and Orthoptera
- boll weevil (*Anthonomus grandis*), pea and bean weevil (*Sitona lineatus*) and stored product weevils (*Sitophilus zeamais*, *Sitophilus granarius* and *Sitophilus oryzae*)



Semiochemicals

- Feromony
 - agregující

Aggregation pheromones

- antipredatory (bugs)
- social (cockroaches)
- southern pine beetle, *Dendroctonus frontalis*
- anti-aggregation pheromones, endo-brevicomin and verbenone



Semiochemicals

- Feromony
 - agregující



Aggregation pheromones

- overwintering clusters
ladybirds
- processionary caterpillars



Semiochemicals

- Feromony
 - značkovací



Epideictic pheromones

- cherry maggot fly *Rhagoletis cerasi* (Tephritidae)
- synthetic fruit-infestation-reducing-agent (0.1x puparia)



Semiochemicals

- Feromony
 - značkovací

Epideictic pheromones

- oviposition deterring pheromone
- ladybirds
- egg window
- larval pygopod
- interspecific



Semiochemicals

- Feromony

- alarmující
- mravenci, vosy, včely, termity
- verbování

Alarm pheromones

- ants, bees, wasps, termites
- recruitment
 - Atta*: small vs. large against ants vs. vertebrates
- Africanized killer bee
 - 1-2 deaths in USA per year



Semiochemicals

- Feromony

- včely
- kouř



Alarm pheromones

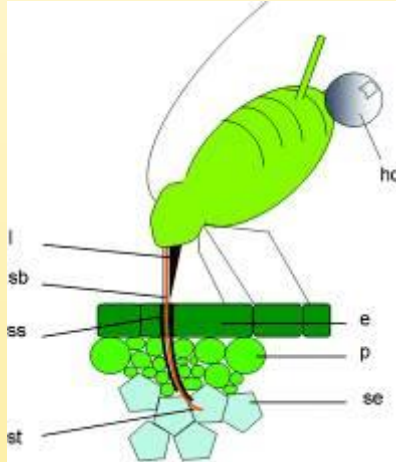
- honey bee

Koschevnikov gland: isopentyl acetate (IPA), butyl acetate, 1-hexanol, n-butanol, 1-octanol, hexyl acetate, octyl acetate, n-pentyl acetate, 2-nonanol...
smoke mask it



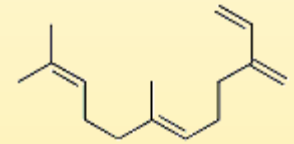
Semiochemicals

- Feromony
 - alarmující



Alarm pheromones

- aphids
 - (E)- β -farnesene
 - walk or drop
 - marking predator
 - sprouting wings
 - plant release
 - puls application



Semiochemicals

- Feromony

- teritoriální
- lépe známé je vyznačení teritoria zvukem

Territorial pheromones

- mark boundaries
- better known stridulation



Semiochemicals

- Feromony
 - stopovací

Trail pheromones

- ants
- quick evaporation, cessation



Semiochemicals

- Feromony
 - vývojové

Primer pheromones

- developmental changes (not behaviour)
 - social insects
 - colonial insects
- queen mandibular pheromone
 - inducing the workers to feed and groom her;
 - inhibiting the workers from building queen cells and rearing new queens;
 - inhibiting ovary development in the workers
 - alcohols and organic acids
- migratory locusts
 - solitary vs. gregarious phase



Semiochemicals

- Alomony



Allomonones

- defence
 - by plants
 - smell (Heteroptera, Diplopoda)
 - osmetaria of swallowtail butterflies
 - methoxypirazines of ladybirds
- Antixenotics: repellents, suppressants, locomotory excitants



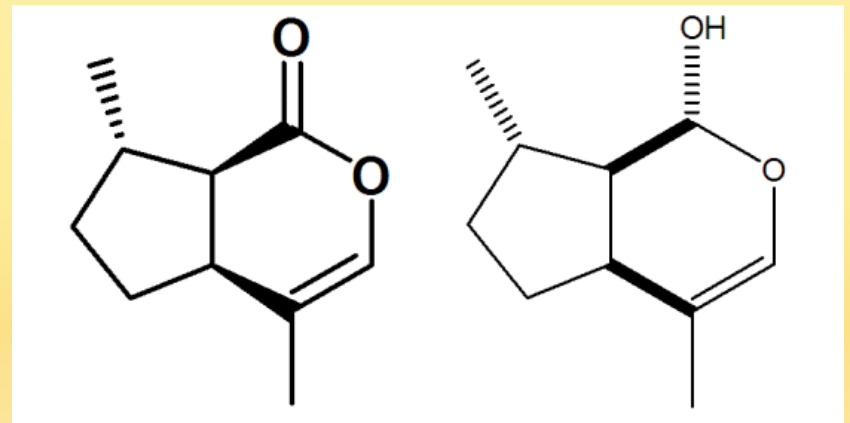
Semiochemicals

- Kairomony



Kairomones

- host finding
 - aphid metabolites
 - bark beetle aggr. ph. by clerid beetle
 - caterpillar frass volatiles
 - aphid honeydew, sex pheromones:
 - (4aS,7S,7aR)-nepetalactone and (1R,4aS,7S,7aR)-nepetalactol



Semiochemicals

- Synonymy

Synomones

- flower scent
- plant call for help
 - allylisothiocyanate
 - Diaeretiella rapae*
 - Brevicoryne brassicae*
 - brocoli



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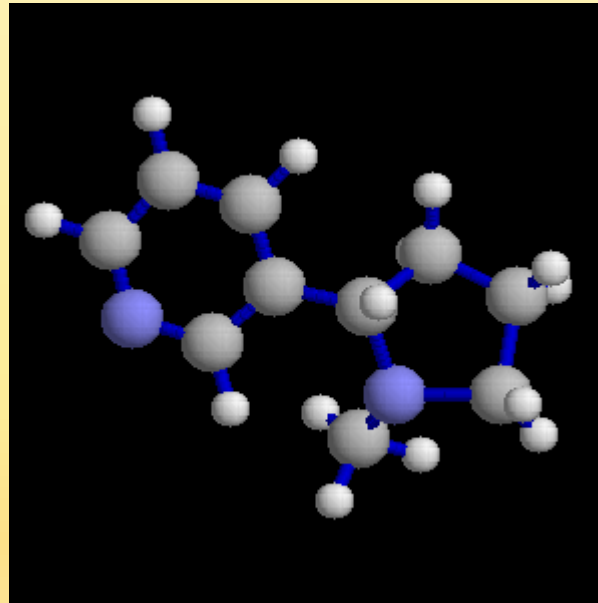
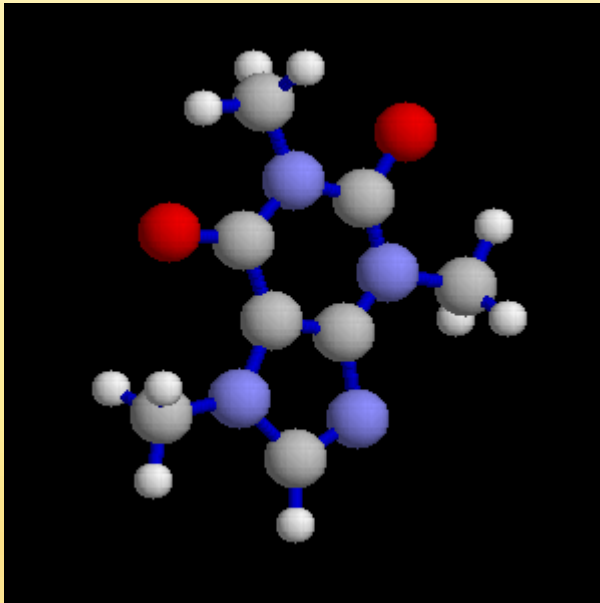


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Insecticides

- Přestávka

Coffee break



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