



Aplikovaná ekologie hmyzu 2014 – 6 semiochemikálie // semiochemicals

Oldřich Nedvěd
katedra zoologie

Přírodovědecká fakulta JU v ČB

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

- allomony
- kairomony
- synomony

- Information

- allomones = emitter +, receiver –
- kairomones = emitter –, receiver +
- synomones = 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



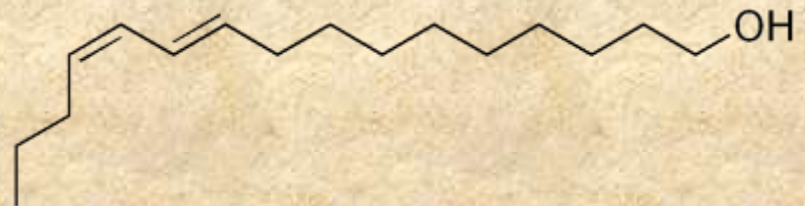
Semiochemicals

- 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

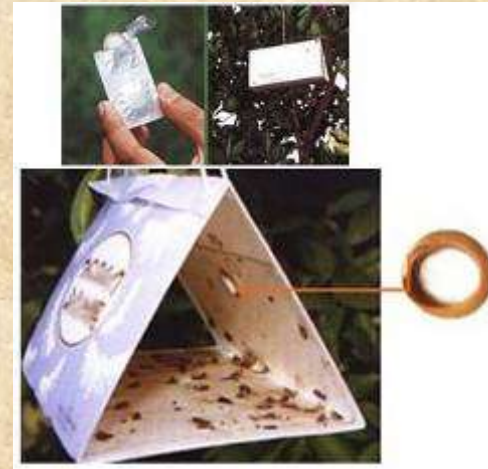


Semiochemicals

- 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



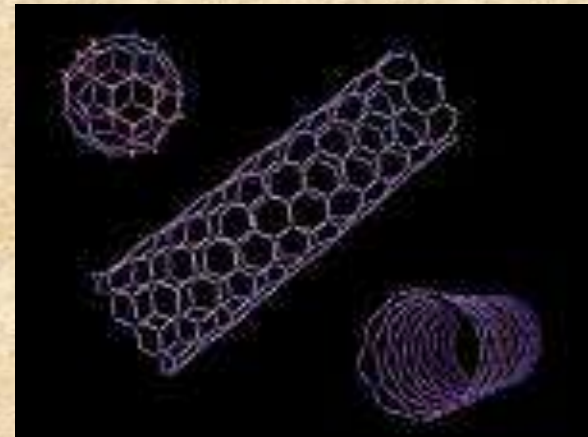
Semiochemicals

- pohlavní feromony

- dezorientace
- práh vnímání

- Sexual pheromones

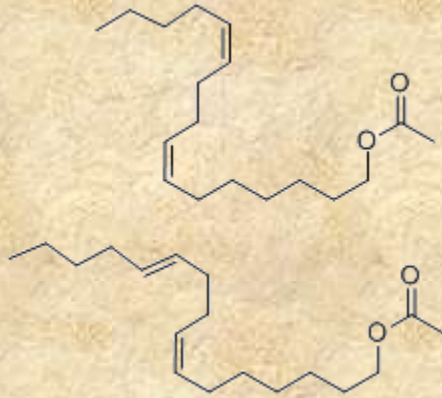
- disorientation, communication (mating) disruption, male confusion
- threshold hypothesis for pheromone perception
- pheromone dispenser
- hollow nanofibres
 - polyamide, cellulose acetate, 33% ph.
- nanotubes



Semiochemicals

- pohlavní feromony

- obaleč bavlníkový



- Sexual pheromones

- pink bollworm, *Pectinophora gossypiella*
- gossypolure = 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
 - květopas 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*
 - 3component 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

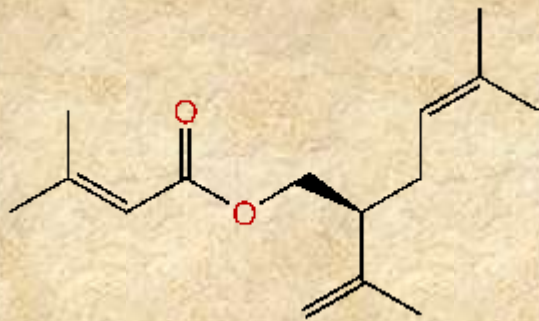
- bark beetle



Semiochemicals

- pohlavní feromony
 - červec

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



Semiochemicals

- pohlavní feromony

- obaleč
- obaleč jablečný
- obaleč mramorovaný



- Sexual pheromones

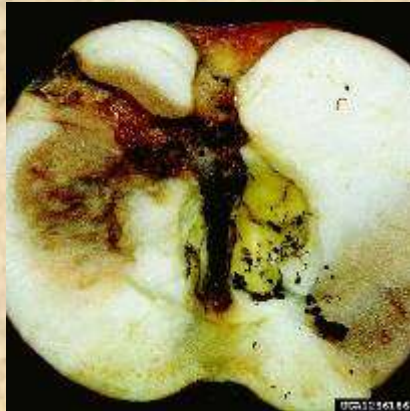
- cherry bark tortrix, *Enarmonia formosana* (Scopoli) (Lepidoptera: Tortricidae)
- Codling moth *Laspeyresia pomonella* L. (Lepidoptera, Tortricidae)
- *Sparganothis pilleriana* and *Lobesia botrana* in vineyards



Semiochemicals

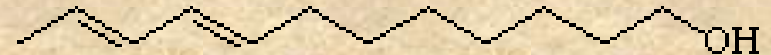
- pohlavní feromony

- obaleč jablečný



- Sexual pheromones

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



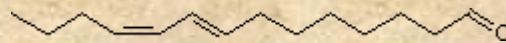
Semiochemicals

- pohlavní feromony

- klíněnka jírovcová, Gracillariidae -
vzpřímenkovití

- Sexual pheromones

- horse chestnut leafminer *Cameraria
ohridella*



(E,Z)-8,10-Tetradecadienal



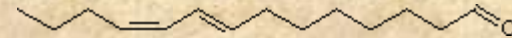
Semiochemicals

- 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, termiti
- 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

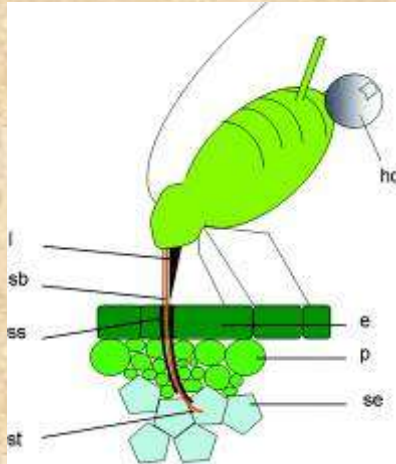
- Alarm pheromones

- 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



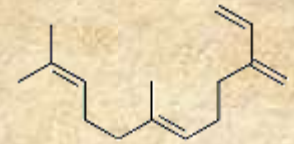
Semiochemicals

- Feromony
 - alarmující



- Alarm pheromones
 - aphids

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



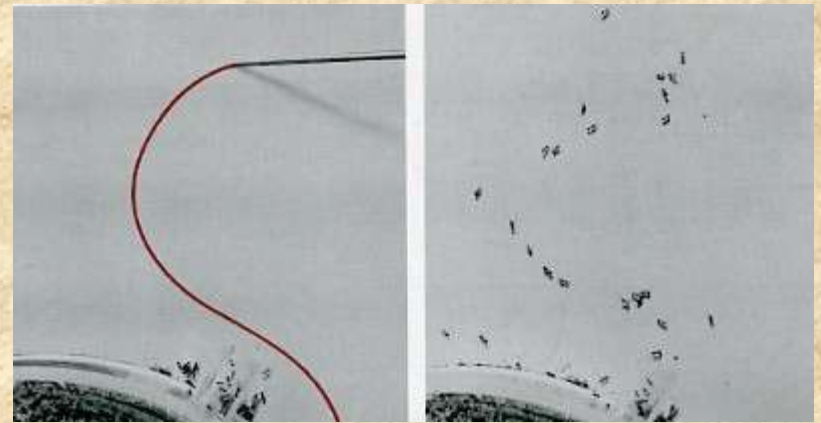
Semiochemicals

- 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



- Allomones

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



Semiochemicals

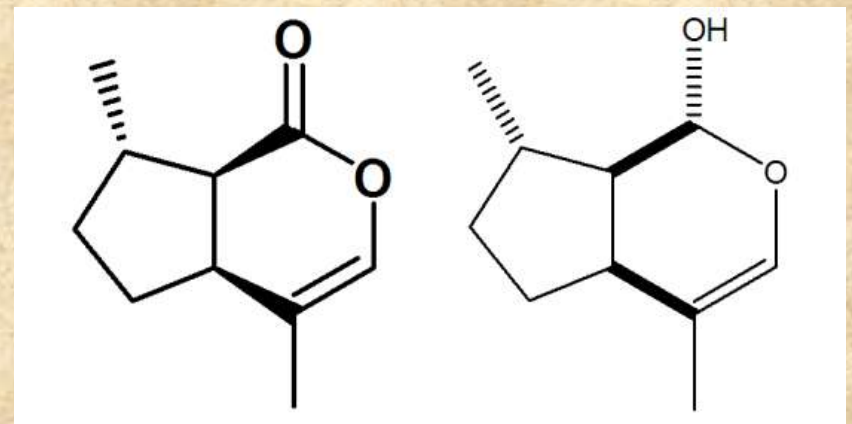
- Kairomony



- 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

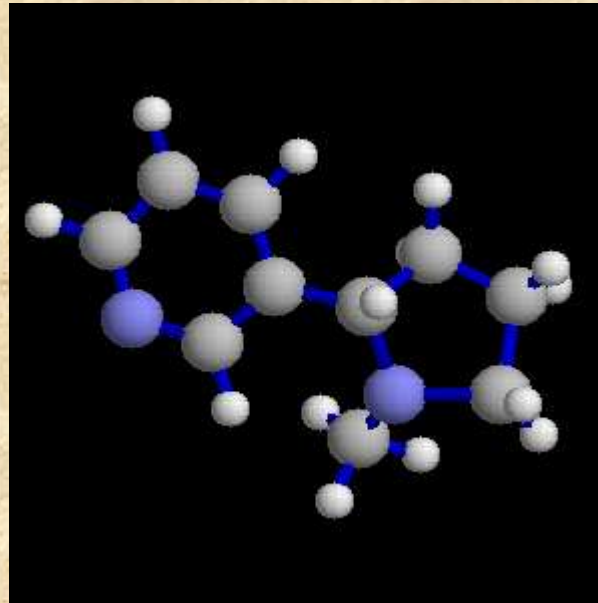
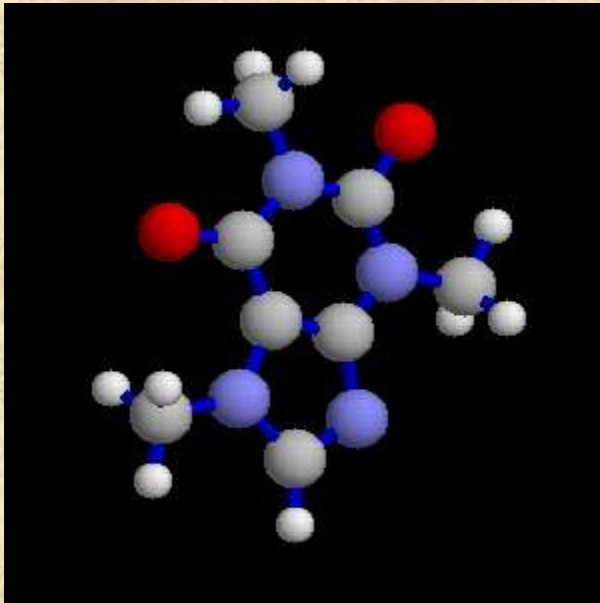
- flower scent
- plant call for help
 - allylthiocyanate
 - *Diaeretiella rapae*
 - *Brevicoryne brassicae*
 - broccoli



Insecticides

- Přestávka

- Coffee break



25.5.2014

Aplikovaná ekologie hmyzu



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