

VETERINARY ENTOMOLOGY

CONTROL OF ECTOPARASITES

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Objectives:

- types & groups of ectoparasiticides
- mechanisms of chemicals on ectoparasites
- prevention & control of ectoparasites



Introduction

- **Ectoparasiticides**

components:

- C, O, N

- S, Cl, I, P

- ring form structure



Types of Ectoparasiticides

- Ectoparasiticides
 1. Neurotoxin
 2. Insect growth regulators
 3. Repellent
 4. Desiccant



Neurotoxin

- Targets
 - CNS
 - synapses
 - axons
 - neuromuscular junctions



Chemicals act as neurotoxins

- Organochlorines
- Organophosphates
- Carbamates
- Triazepentadienes



Chemicals act as neurotoxins

- Phenylpyrazoles
- Pyrethrins
- Pyrethroids
- Macrocyclic lactones



Organochlorines

- long-term residues
 - DDT
 - BHC
 - dieldrin
- prohibited



Organochlorines

- less persistence
 - methoxychlor
 - toxaphene
 - lindane
- against biting flies & lice



Organophosphates

- cholinesterase inhibitor
- insecticides & pesticides

Diazinon

Chlorpyrifos

Phosmet

Malathion

Dichlorvos

etc.



Organophosphates

- applications

spray

dip

spot-on

collar

- disadvantage

- long-term residues

- neurotoxic to pets



Carbamates

- anticholinesterase
- less toxicity
- carbaryl
- bendiocarb
- propoxur



Triazepentadienes (formamidines)

- Amitraz
- cattle: tick & lice
- pig: sarcoptic mange
- dog: demodectic mange



Phenylpyrrazoles

- inhibit **GABA** (neurotransmitter gamma-aminobutyric acid)
- specific to invertebrates
- **Fibronil**: lipophilic
 - prevention: flea allergic dermatitis



Pyrethrins

- natural product of pyrethrum
- *Chrysanthemum cinereariaefolium*
- rapid knockdown
- poor residual activity



Pyrethrins

- degraded by sunlight
- synergistic effects with piperonyl butoxide
- applications: powder & shampoo
- against lice & flea



Pyrethroids

- synthetic chemicals of pyrethrin
- greater stability than pyrethrin
- microencapsulation portion



Pyrethroids

- Permethrin
- Cypermethrin
- Deltamethrin
- Fenvalerate



Pyrethroids

- control: flea, insect, lice, tick, ked
- applications: shampoo, spray, powder, collar



Macrocyclic lactones

- Avermectins
 - ivermectin*
 - abamectin*
 - doramectin

* *Streptomyces avermytilis*



Macrocyclic lactones

- Milbemycins
 - milbemycin
 - nemadectin*
 - moxidectin

* *Streptomyces cyanogriseus*



Macrocyclic lactones

- less toxicity to vertebrates
- broad spectrum
 - arthropods
 - nematodes
 - endoparasites



Insect growth regulator (IGR)

- inhibit
 - growth
 - metamorphosis
 - reproduction
- very specific to insects



Juvenile hormones & analogues



- Methoprene
- Fenoxycarb with pyrethroids, OP



Juvenile hormones & analogues

- Pyriproxifen
 - control flea
 - spray
 - collar
 - wash



Chitin synthesis inhibitors

- exoskeleton: **chitin** (amino-sugar polysaccharide)
- **Benzoylphenylureas (BPU)**
 - inhibit chitin microfibrils



Chitin synthesis inhibitors

- Benzoylphenylureas (BPU)
 - diflubenzuron
 - triflumuron
 - lufenuron



Other insect growth inhibitors

- Triazine derivatives (cyromazine)
 - affect on higher diptera
 - inhibit molting
 - inhibit pupation



Repellent

- pyrethrin
- diethyltoluamide (DEET)
- ethanhexadiol
- dimethyl phtholate
- butopyronoxyl



Desiccant

- alter the environmental microclimate
- control: fleas & free-living mites
- sodium polyborate



Mode of ectoparasiticide application

- Topical preparations
- Systemic preparations
- Environmental preparations



Topical Preparations

- dip, sponge-on
- spray, powder
- mousses
- collar, ear tag



Systemic Preparations

- routes: injection, oral, topical
- insects get drug during feeding
- on-host ectoparasites



Systemic Preparations: disadvantage

- advancing prophylaxis
- re-infestation of ectoparasites
- problem of dermatitis



Environmental Preparations

- off-host ectoparasites
- long-term residues
- ectoparasites may escape from contacting the chemicals



Problems with chemical control

- side-effects
- poisoning
 - overdose
 - species & breed sensitivity
 - drug interaction
- non-target organisms



Poisoning & Environmental Contamination

- OC1, OP residues
- cat: lindane sensitive
- dung beetle: dichlorvos, coumaphos, cruformate



Poisoning & Environmental Contamination

- avermectins: toxic at low dose on dung beetle
- pyrethroids:
 - toxic to crustaceans & fish
 - overdose: neurotoxic in dog & cat



Resistance: causes

- overdose
- inappropriate treatment
- slow-releasing chemicals



Non-Chemical Control of Ectoparasites

- **objective:** reduction of ectoparasites population
- **method:** environment modification
- **goal:** increase mortality
decrease fecundity



Physical Control

- removal of dung
- removal of moist bedding & straw
- reduce of direct contact to ectoparasites



Barriers

- prevent animals from ectoparasites
ex. fine mesh screen
- insecticides may be used also



Biological Control

- relationship
 - predator
 - competitor
 - pathogen
- *Steinernema carpocapsae* on *Ctenocephalides felis*



Vaccination

- vaccine against ticks in cattle and dog
- Ag: intestinal cells & salivary gland of ticks



Trapping

- visual trap
- olfactory trap
- tactile trap
- chemical trap
 - pheromone & CO₂



Sterile Insect Technique

- Increasing of mating b/w sterile male and female insects



Success of the technique

- huge number of released sterile males
- mating competition with wild males
- no immigration of wild insects



Modeling & Forecasting

- prediction of insect seasonal patterns for:
 - prevention
 - prophylaxis
 - treatment with non-chemical methods

