VMP 930
Veterinary Parasitology

Fleas
(Siphonaptera)
Flea - Adult Anatomy

- **Insect** (head, thorax, abdomen, 6 legs)
- Laterally flattened
- Hind legs for jumping (saltatory locomotion)
- Well developed mouth parts for piercing skin and sucking blood
- Strong claws for clinging to host and moving about the host
Flea - Life Cycle

- Complex metamorphosis (= Holometabolous)
  - Egg, Larva(x3), Pupa, Adult
- Adults (male & female)
  - feed on blood (= parasitic)
  - mate on the host
  - take multiple meals throughout life
  - female lays multiple clutches of eggs
    - few eggs each time but several hundred in lifetime
Flea - Life Cycle

- Eggs laid on host, fall off host in to the environment
- Larvae - caterpillar-like
  - Three larval instars
  - Grow & molt b/w instars
  - Non-parasitic, feed off host.
  - Chewing mouth parts for feeding on organic debris (sloughed skin, scales, scabs, dried host blood, castoff exoskeletons, adult feces, etc.)
Flea - Life Cycle

- Pupae - metamorphosis stage
  - Pupate in a cocoon of silk mixed with environmental debris.
  - Metamorphosis may take few days to months depending on environmental conditions.
  - May remain in puparium for months.
  - Adults emerge from puparium when host vibrations are detected.
Flea - Life Cycle

**Adult**
(Female: 4 mm long)
(Male: 2 - 3 mm long)
Take several blood meals daily.

**Eggs**
(white: 0.5 mm long)
Eggs laid on pet (25 - 40 eggs per day).
Eggs fall off pet and hatch in environment.
Hatch in 2 - 5 days.

**Pupa**
(2 - 4 mm long)
Pupa in silk cocoon with debris collected on outside.
Fleas emerge 1 - 2 weeks in environment.
Delayed emergence up to 4 months.

**Life Cycle of the**
**Cat Flea**
*Cat* *fleas*

**First Stage Larva**
(1 - 2 mm long)

**Second Stage Larva**
(2 - 3 mm long)

**Third Stage Larva**
(3 - 5 mm long)

Illustration by: Scott Charlesworth, Purdue University
Fleas of Minor Importance

- *Pulex irritans* - human flea - may be on pets
- *Xenopsylla cheopsis* - Oriental rat flea - rodents - *Yersinia pestis* - plague
- *Echidnophaga gallinacea* - stick-tight flea - birds, dogs, man - embeds in host
Fleas of Veterinary Importance
*Ctenocephalides* spp.

- Most fleas on dogs and cats in NC are *C. felis*
Flea Preferred Habitat

- Temperature of 13-32°C (55-90°F)
  (>35°C (95°F) lethal to larvae and pupae)
- Relative humidity of 60-92%
  (<60% humidity die from desiccation)
- ↑ Temperature + ↓ Humidity = ↑ Death
- Life Span: ~ 14-28 days (max of ~140 days)
- Unfed adults may survive ~ 2 months
Flea Host Habitat

- Adult fleas prefer the back, neck, and ventral regions of pets.
  - Fleas are less likely found on the legs and tail.
  - Host grooming habits affects distribution of adult fleas on the host.
Flea Ecology

- Adults rarely leave host
  - exception >200 fleas/individual host
- May bite other hosts, including man, if dog/cat not available
Flea Diagnosis

- Observe fleas, 'flea dirt', effects of bites on host
  - Wet paper towel test.
- Observe fleas, 'flea dirt', in environment
  - Examine pet bedding
  - White sock test -- Walk through suspect area with high white socks.
Fleas - Pathology

- Blood loss - can produce anemia especially in young animals if infestation severe
- Inflammation & pruritus
- Self-trauma via scratching
- Allergy - flea bite dermatitis
- Disease transmission
  - *Dipylidium caninum, Dipetalonema reconditum*
  - Also viruses, bacteria, rickettsia.
Flea Allergy Dermatitis

- More than 15 substances injected by fleas capable of eliciting an allergic response (& more intense self-trauma)
- Diagnose with intradermal skin test
- Once allergic, always allergic
- A single flea is capable of eliciting a severe reaction in allergic animal
- Treatment may include steroids - use for only short periods of time
- Eliminate fleas!!!!!!!
- Larvicides should be part of control program.
Flea Allergy Dermatitis

- Flea punctures skin to feed.
- Flea saliva sets up an antigen-antibody reaction.
- Excoriation and inflammation result from self-inflicted trauma.
- Acute bacterial infection results.

**Diagnostic Plan**
- History
- Physical examination
- Detection of fleas, flea dirt, and tapeworm segments
- Intradermal skin testing

**Therapeutic Plan**
- Flea control
- Short-term corticosteroids

**Dietary Plan**
- A diet adequate for tissue repair
Flea Allergy Dermatitis

Flea allergy dermatitis

[Image of a cat with fleas]

[Image of a cat with skin irritation]

[Image of a cat's skin with red spots]

[Image of a cat's skin with red spots close-up]

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Flea Control

- Integrated control program should include the host (adult fleas) and the host's environment (eggs, larvae, pupae, adults).
  - Majority of flea population is in the environment.

- Adult fleas only account for 5% of the total flea population.

- The other 95% are the eggs, larvae and pupae that remain hidden in carpets, furniture, dog bedding and the garden, waiting to develop and jump onto the dog.
Flea Control

- Environmental Control
  - 1st Remove pet from infested environment
  - Physically treat environment --- Vacuum
  - Use chemicals to treat environment
    - Sprays, foggers - Residuals, knockdowns
    - Insect growth regulators

- Control on host
  - Dips, Sprays, Powders, Shampoos, Flea collars, Systemics.
Flea Control

- **LARVICIDES**
  - Insect growth regulators (IGR’s)
    - Prevents development of next generation
    - Prevents eggs from hatching & kills larvae, early pupae
    - Lufenuron, methoprene, pyriproxyfen
  - May take up to 3 months to achieve control with only Larvicides.
Flea Control

- **Adulticides - Some options**
  - Imidacloprid (Ex: Advantage, Seresto-q8m, Simparica) q30 days
  - Fipronil (Ex: Frontline) q30 days
  - Selamectin (Ex: Revolution)- q30 days
  - Dinotefuran (Ex: Vectra 3D)- q30 days
  - Nitenpyran (Ex: Capstar) Rapid kill- One-time administration
  - Spinosad (Ex: Trifexis)-q30 days
  - Afoxaloner (Nexguard)- q 30 dys
  - Fluralaner (Ex: Bravecto) q3m
  - Etc.

- Type depends on preferred route and risk of other parasites (ex: need for tick prevention)
Insecticide resistance

- Isolates of *C. felis* have been found to be resistant to various insecticides
  - (DDT, dieldrin, malathion, chlorpyrifos, diazinon, propetamphos, bendiocarb, cyfluthrin, cypermethrin, fluvalinate, permethrin, pyrethrin, and carbaryl)

- Resistance to topical adulticides is currently being investigated
Flea Control

- Also see CAPC Guidelines (Companion Animal Parasite Council)
- https://capcvet.org/guidelines/fleas/
How would one control *Ctenocephalides* in the following situations?

*Hint: Adulticide, Larvicide, Environmental Control*

- A completely indoor cat that has flea bite allergy.

- A group of dogs in an outside kennel.

- A household with a completely indoor cat (not allergic) and a dog that spends time both indoors and outdoors.