Insect Pests and Poultry
Do you know me and how to treat me properly?

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The Connecticut Agricultural Experiment Station
The Connecticut Agricultural Experiment Station

- First Agricultural Experiment Station in U.S.
- Founded in 1875 (10th oldest agency CT)
- Independent state supported research agency
- Facilities New Haven, Hamden, Windsor
- Departments: Analytical Chemistry, Biochemistry & Genetics, Entomology, Forestry & Horticulture, Plant Pathology & Ecology, Soil & Water
- Insect identification, plant disease diagnosis, soil testing, tick testing, mosquito surveillance.
Pests in the Poultry House

- House Fly
  *Musca domestica*
- Little House Fly
  *Fannia canicularis*
- Black Garbage Fly
  *Hydrotaea aenescens*
- Lesser Mealworm
  *Alphitobius diaperinus*
- Hide Beetle
  *Dermestes maculatus*
- Northern Fowl Mite
  *Ornithonyssus sylviarum*
- Chicken Mite
  *Dermanyssus gallinae*
- Bed Bug
  *Cimex lectularius*
House Fly *Musca domestica*

- ¼ inch long
- 4 black stripes
- Breed any warm decaying organic material
- Adults live avg. 3-4 weeks
- Become active ~ 45-50° F
  - Live 91 days @ 60° F
  - Heat paralysis @ 112 °F
- Egg laying ceases < 50 °F
- Fly ½ to 20 miles
Window Fly Activity
House Fly Life Cycle

A = eggs, B = larvae, C = larva-forming puparium, D = pupae, E = adult.

10 days at 85° F; 21 days at 70° F; 45 days at 60° F
Public Health and Fly Management in Residential Communities

• The most common and usually most desirable and economical method of disposing of livestock manure is application to cropland or pasture.
• Farmers in urbanizing settings can experience problems during manure hauling when accessing fields near urban developments.
• The presence of filth flies, primarily the house fly, and dispersal from either the farm site or from manure applied to fields is an increasing problem. As people move out of cities to suburban areas and suburban areas expand into rural areas, there is potential for an escalation of manure and fly related conflicts.
Dispersal of flies from poultry, dairy, and other manure distributed in fields as fertilizer will depend upon

- the fly burden in manure
- the stage of fly present in the manure
- conditions upon delivery and/or spreading of the manure
- distance to residential areas
- storage of the manure
Fly Dispersal

And there came a grievous swarm of flies into the house of Pharaoh, and into his servants’ houses, and into all the lands of Egypt. – Exodus 8:24

- *M. domestica* disperse all directions
- Dispersal tied to food availability (only 8-30% disperse beyond dairy or poultry)
- Rate dispersal increases above 53° F and when breeding materials are scarce
- Flies move upwind with steady 2-7 mph wind as they move towards attractive sites, otherwise “random”, another study threshold was 10 mph for directed migration
- Disperse at least half mile in 3-8 to 24 hours
# Summary of Data Fly Dispersal

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Effective dispersal range</th>
<th>Max. dispersal range</th>
<th>Approx. dispersal rate</th>
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<tbody>
<tr>
<td>Rural (TX)</td>
<td></td>
<td>13 mi</td>
<td></td>
</tr>
<tr>
<td>Farms (OR)</td>
<td></td>
<td>12 mi</td>
<td></td>
</tr>
<tr>
<td>Urban (AZ)</td>
<td>&lt; 1 mi</td>
<td>5 mi</td>
<td>4 mi/3 days</td>
</tr>
<tr>
<td>Rural (GA)</td>
<td>&lt; 3 mi</td>
<td>10 mi</td>
<td>5 mi &lt; 24 hr</td>
</tr>
<tr>
<td>Urban (GA)</td>
<td>½ - &gt; 1 mi</td>
<td>7.6 mi</td>
<td>5.2 mi/24 hr</td>
</tr>
<tr>
<td>Urban (AZ)</td>
<td>½ -2 mi</td>
<td>7.2-8.3 mi</td>
<td>5.2 mi/24 hr</td>
</tr>
<tr>
<td>Farm (NJ)</td>
<td>½ -2.5 mi</td>
<td>6.5 mi</td>
<td></td>
</tr>
<tr>
<td>Farms (MD)</td>
<td>½ - &gt; 1 mi</td>
<td></td>
<td>½ mi/4 hr</td>
</tr>
</tbody>
</table>
Distribution of Dispersal

- Maximum 7-20 miles
- 50% within ½ mile
- 60-80% within 1 mile
- 85-95% within 2 miles
- 10-30% of total
- 50% within ½ mile
- 15% of total
- Maximum 7-20 miles
Don’t Let Your Fly Numbers Run Away On You

Fly control is important to good community relations

Source: To Know a Fly
Factors in Nuisance Action

- Tolerance of the local citizens for house flies in their environment
- Proximity to villages, cities, and urban areas (to farms and agricultural fields)
- Professional inspections of complainant homes
- Number of complainants and over what time period
- Specific identification of the nuisance flies as house flies or other fly species
- Other possible sources of house flies
- Time of year
- Number of samples taken and over what time period
- Existence of a properly executed house fly control plan at a farm or CAFO (concentrated animal feeding operation)
CT Public Health Code

  (c) **Barns or stables, hogpens, chicken yards or manure piles or accumulations of organic material so maintained as to be a breeding place for flies.**
  (d) The discharge or exposure of sewage, garbage or any other organic filth into or on any public place in such a way that transmission of infective material may result thereby.
  (e) Privies not screened against flies in populous districts and privies likely to pollute the ground or surface water from which water supply is obtained.
  (f) **Transportation of garbage, night soil or other organic filth except in tight, covered wagons which prevent leakage or access of flies.**
CT Public Health Code

• Reg. No. 19-13-B2. Abatement of nuisance
• (a) Any local director of health, upon information of the existence of a nuisance or any pollution occurring within his jurisdiction, or when any such nuisance or pollution comes to his attention, shall, within a reasonable time, investigate and, upon finding such nuisance or pollution exists, shall issue his order in writing for the abatement of the same.
• (b) Such order shall specify the nature of such nuisance or pollution and shall designate the time within which such abatement or discontinuance shall be accomplished; and if such order is not complied with within the time specified, the facts shall be submitted to the prosecuting authority. Copies of all orders shall be kept on file by the director of health in his office and copies of the same shall be furnished the state commissioner of health on request.
• 19-13-B21. Garbage and refuse
• (a) The owner of premises upon which persons reside or which are frequented for pleasure or business shall keep such premises free from accumulations of garbage, rubbish, rags, tin cans, paper, empty barrels, boxes or any material which, because of its character, condition or improper storage, may invite the breeding or collection of flies, mosquitoes or rodents, or which may in any other prejudice the public health.
• (b) In populous districts stable manure shall be kept in a covered water-tight pit or chamber and shall be removed at least once a week during the period from May first to October first and during the other months at intervals sufficiently frequent to maintain a sanitary condition satisfactory to director of health. Manure on farms or isolated premises other than dairy farms need not be so protected and removed unless ordered by the director of health.
Other Pests Poultry House

- Little House Fly
  *Fannia canicularis*
- Black Garbage Fly
  *Hydrotaea aenescens*
- Lesser Mealworm
  *Alphitobius diaperinus*
- Hide Beetle
  *Dermestes maculatus*
Little House Fly, *Fannia canicularis*

- Resembles house fly
- Smaller, 3 brown stripes
- Associated litter-covered floors
- Males “aimless” circling flight behavior
- Larva very distinctive
- Egg-Adult 18-22 days
Little House Fly Larva
Black Garbage Fly  
*Hydrotaea (Ophyra) aenescens*

- Shiny bronze-black
- Slightly smaller house fly
- Life cycle 14-45 days
- Adults tend to stay on food source rather than ceilings
Cluster Fly, *Pollenia rudis*

- Family Calliphoridae
- Larvae parasites of some earthworms
- Nuisance as overwinter in buildings - seek protected place late summer or fall, can emerge warm days, cluster at windows, etc.
- Fly traps don’t work
Lesser Mealworm
Alphitobius diaperinus

- About ¼ inch in size
  Larvae ¾ inch long
- Wireworm-like larva
- Stored product pest
- Dwell mainly in manure or litter
- Adults feed on damp and moldy grain
- Vector pathogens, structural damage housing & insulation
- Nuisance, disperse urban areas
• Adults dark brown, white underneath, 1/3 inch
• Larvae 1/2 inch long
• Feed on bird carcasses, skins, broken eggs, hides, feathers, other animal and plant products
• 7 instars 40-60 days
• Larvae bore into wood posts, beams, paneling, drywall, insulation
Dispersal Litter Beetles
Other Pests Poultry House

- Northern Fowl Mite
  *Ornithonyssus sylviarum*
- Chicken Mite
  *Dermanyssus gallinae*
- Bed Bug
  *Cimex lectularius*
Northern Fowl Mite
*Ornithonyssus sylviarum*

- External parasite feeds on blood
- Mites irritate and stress birds, loss production 10-15%
- Live on bird, congregate 1st on vent, then tail, back and legs
- Feathers become soiled – blackened feathers, scabs
Chicken Mite (Red Mite) *Dermanyssus gallinae*

- External parasite feeds on blood
- Lives off host in cracks, crevices
- Feeds at night
- Both chicken mites and northern fowl mites irritate and stress birds resulting in emaciation and lowered egg production.
- Chicken mite will attack humans
- Associated with other birds
Bed Bugs
Hemiptera: Family Cimicidae

- About 100 species
- Bloodfeeders, prefer humans, also birds, bats, rodents
- Common bed bug *Cimex lectularius* L.
- Companion man for centuries
- Flattened, 3/16 inch
- Musty, sweetish odor
- Increasing human problem, also feed on poultry

Feed at night, hiding behind insulation, wall cracks, loose boards, nests (beds, walls, mattresses, headboards, night stands, outlet covers, wall paper, phone jacks, etc.)
Bed Bugs in Poultry

Bed bugs in Poultry. Bed bugs, usually the human bed bug, are generally found in breeder flocks or other floor-housed birds. They hide, breed, and lay their eggs in nests, behind nest boxes, under loose boards, and in cracks around the walls, roosts, and roofs of buildings. At night, young and old bed bugs crawl onto birds and suck blood. Because they are found hiding during the daytime in cracks, around walls, and in equipment, they can best be controlled by treating these areas.

“Poultry Bugs” comprise several species found mainly in tropical areas, including CA and southeastern U.S.
Mexican chicken bug, *Haematosiphon inodorus*
Brazilian chicken bug, *Ornithrocoris toledo*
Swallow bug, *Ornithocoris pallidus*
The Bat Bug: *Cimex adjunctus* Barber
Also *Cimex pilosellus*

Little brown bat infested with bat bugs, 2008
Resurgence of the Human Bed Bug, *Cimex lectularius* L.

- Thousand-fold increase in bed bug inquiries at CAES from private citizens, health professionals, and pest control operators
Bed bugs may be found:

- Universities, colleges, and schools
- Halfway homes
- Correctional facilities
- Hospitals
- Homeless shelters
- Self-storage facilities
- Moving vans, delivery trucks
- Rental furniture
- Churches
- Theaters
- Airports
- Taxis
- Discarded furniture and mattresses
- Hotel, motels, inns etc........
Human Bed Bug

3 Stages

- Adult female
- Adult male
- Newly hatched nymphs and egg cases
The Life Cycle of a Bed Bug

**Egg**

1. Hungry 1st Instar Nymph
   - Blood-fed 1st Instar Nymph
2. Hungry 2nd Instar Nymph
   - Blood-fed 2nd Instar Nymph
3. Hungry 3rd Instar Nymph
   - Blood-fed 3rd Instar Nymph
4. Hungry 4th Instar Nymph
   - Blood-fed 4th Instar Nymph
5. Hungry 5th Instar Nymph
   - Blood-fed 5th Instar Nymph

**Adults**

- Adults Feed and Mate
- Multiple Times

- Hungry Adult Female
  - Mate
  - Hungry
- Adult Male

- Blood-fed Adult Female

- Blood-fed Adult Male

- Lays Eggs

- Hatches

- Molts

- Seeks Host

- Leaves Host Fully Fed

*John F. Anderson*
Behavior

Take a blood meal in 3-8 min. often just before dawn when host is in the deepest stage of sleep.

Often bite in “rows” at the edge of clothing and bedding or in clusters.

Human bed bugs prefer humans, but can “host switch” and readily on birds, guinea pigs, hamsters, rabbits, chinchillas, ferrets, rodents, and other mammals.
Don’t Let the Bed Bugs Bite!

Bites on Arm Showing Rounded Swellings with Diffuse Redness

Forearm Showing Linear Blisters

Forearm Showing Multiple Blisters from Bed Bugs in a Sleeping Bag

Leverkus et al. 2006, J Invest Dermatol 126:91-96

Inspecting for Bed Bugs

• Starting with the bed, start from the top down
  Check for blood stains, cast skins, eggs, bed bugs
  Lift and inspect as you go
  Inspect mattress seams, tufts, and box spring
• Then inspect bed frame
• Work out to surrounding furniture etc.
  Inspect baseboards near bed, drawers, behind headboard, etc.

Slide courtesy Mike Lipsett, CT Pest Elimination
Bed Bug Inspection and Control

Pest Mgmt Professional will:
Conduct Inspection
Treat with chemical or non-chemical methods
Follow-up Treatment

Treatment Failure

Cluttered apartment
Pesticide resistance

White sheet on bed
Bed bugs in refrigerator
Connecticut Coalition Against Bed Bugs

- Local Health Department
- CT Department of Public Health
- CT Agricultural Experiment Station
- CT Department of Environmental Protection, Pesticide Management Division
- CT Division of Criminal Justice Housing Division
Objectives and Projects

- Education and Public outreach
- Research
- Policies and Protocols
  Schools, visiting nurses, health agencies, best practices for bed bug management mattress, bedding and upholstered furniture. Guidance document for the reuse/resale and recycling industries in Connecticut
- Training
- Forums
- CT Bed Bug Pest Management Professionals service list (NPMA)
Integrated Pest Management (IPM) for Poultry

- Monitor pest and biological control agent populations. (learn to identify the arthropods involved)
- Use appropriate management techniques and biological control agents to suppress fly (and other pest) populations.
- Allow producers to decide if a pesticide application is needed to control pests and apply at the proper time and place.
- Avoid unnecessary and unprofitable pesticide applications.
High-rise Poultry House

Pests: Flies, Beetles, Mites

Beneficial Insects & Mites

Caged Layer
Broiler
Breeder
Mechanical & Cultural Control
Flies Mainly Water Control Issue
Fly Monitoring

Fly Control mainly sanitation & moisture management issue
Axtell (1970) introduced the spot card and recommended its use as a fly monitoring tool.

**Advantages:**
- Easy
- Inexpensive
- Allows consistent sampling of the same locations over time
- Measures activity over a week rather than giving snapshot of instantaneous fly activity
- Good tool for monitoring fly populations indoors

**Disadvantages:** does not distinguish among fly species; temperature dependent
Mean No. House Flies per Commercial Fly Trap after 7 days

Important Factors: Bait Trap design/geometry

Fly Trap Evaluations

Filth Fly Symposium, CDR Daniel Szumlas and Dr. Todd Walker
Navy Entomology Center Of Excellence, Jacksonville, Florida; Dr. Chris Geden and Dr. Jerry Hogsette, USDA Gainesville, FL
Biological Control

Macrochelid & Uropodid Mites

Macrochelid Mite
Macrocheles muscaedomesticae

Uropodid mite
Fuscurpoda vegetans

Hister beetle
Carcinops pumilio

Pteromalid wasps
Macrocheles muscaedomesticae

- Macrochelidae
- < 1/16 inch in size
- Feeds on house fly eggs & 1st instars
- Found outermost layer manure where prey eggs deposited
- Fairly rapid movement
- Can become established after 3-4 weeks manure accumulation

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Close-up Macrochelid mite
Fuscuropoda vegetans

- Uropodidae
- < 1/16 inch in size
- Feeds on house fly 1st instar larvae
- Found deeper in manure
- Complements macrochelids
- Can become established after 3-4 weeks manure accumulation

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Hister Beetle
*Carcinops pumilio*

- Small (1/8 inch), black
- Adults and larvae feed on eggs & 1\textsuperscript{st} instars house fly
- Live surface layers
- Take 6 wks for population to build up
- Disperse in spring, attracted to black light

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Parasitoids Family Pteromalidae

*Muscidifurax raptor* female laying eggs through house fly puparium

House fly puparia, each with a hole from which a single wasp emerged after feeding on the pupa

*Spalangia endius* wasp larva feeding on house fly pupa

*Spalangia endius* wasp pupa
## Comparison of Muscidifurax raptor and M. raptorellus life history

<table>
<thead>
<tr>
<th></th>
<th>M. raptor</th>
<th>M. raptorellus</th>
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<tbody>
<tr>
<td>Breeding area</td>
<td>House fly pupae</td>
<td>House fly pupae</td>
</tr>
<tr>
<td>Movement</td>
<td>Up to 50 feet</td>
<td>Up to 15 feet</td>
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<tr>
<td>Fecundity</td>
<td>20 eggs/day</td>
<td>20 eggs/day</td>
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<tr>
<td>Eggs per pupa</td>
<td>1</td>
<td>4 to 8</td>
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<tr>
<td>Development</td>
<td>Egg-Adult 17 days</td>
<td>Egg-Adult 16 days</td>
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<tr>
<td>Life span</td>
<td>2 weeks adult</td>
<td>2 weeks adult</td>
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<tr>
<td>Generations</td>
<td>About 15</td>
<td>About 15</td>
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<tr>
<td>Release level</td>
<td>2-4 pupae/bird/wk</td>
<td>1 pupa/bird/wk</td>
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**M. raptor** release schedule for late spring and summer cleanout

<table>
<thead>
<tr>
<th>Week Post Cleanout</th>
<th>Parasitoids per bird</th>
<th>No. pupae per bird</th>
<th>Colonies/bird house/wk</th>
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<tbody>
<tr>
<td>1, 2</td>
<td>2</td>
<td>2</td>
<td>20</td>
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<tr>
<td>3, 4, 5</td>
<td>8</td>
<td>8</td>
<td>80</td>
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<tr>
<td>6, 7, 8</td>
<td>4</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>9, 10</td>
<td>2</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>11 +</td>
<td>If necessary</td>
<td>If necessary</td>
<td>-</td>
</tr>
</tbody>
</table>

Total: 440 colonies; one colony = 10,000 parasitized fly pupae
Chemical Control

- Residual sprays
  Pyrethroids, organophosphates, neo-nicotinoids, IGR, boric acid
- Space or mist sprays
  Pyrethroids, organophosphates, botanicals, IGR
- Baits
  Carbamates, Spinosyn, neo-nicotinoids
- Manure treatments
  Organophosphates, substituted melamine
Fly Management Handbook

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The End
From red-bugs and bed-bugs, from sand-flies and land-flies,
Mosquitoes, gallinippers and fleas,
From hog-ticks and dog-ticks, from hen-lice and men-lice,
We pray thee, good Lord, give us ease.

(An Old Prayer: circa 1856)