Livestock and Poultry Integrated Pest Management Resources in Maine

Maine Agricultural Trades Show, January 15, 2025

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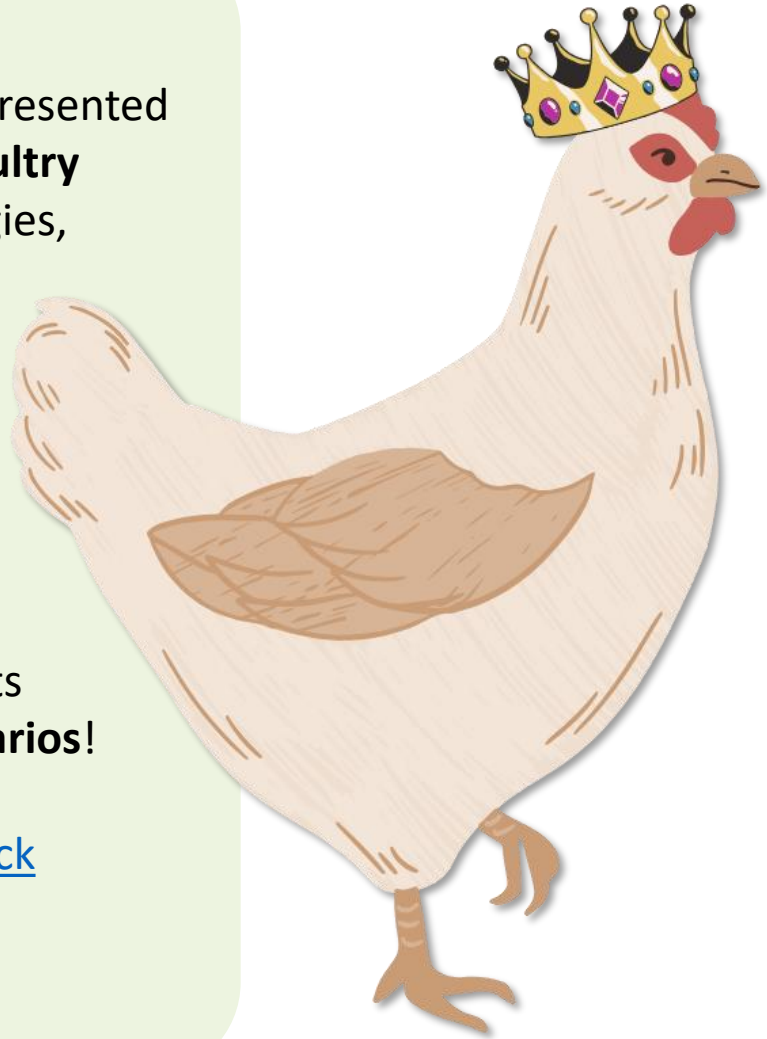
MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Photo: ACES Janet Guynn (CC0 1.0 Universal)

Overview

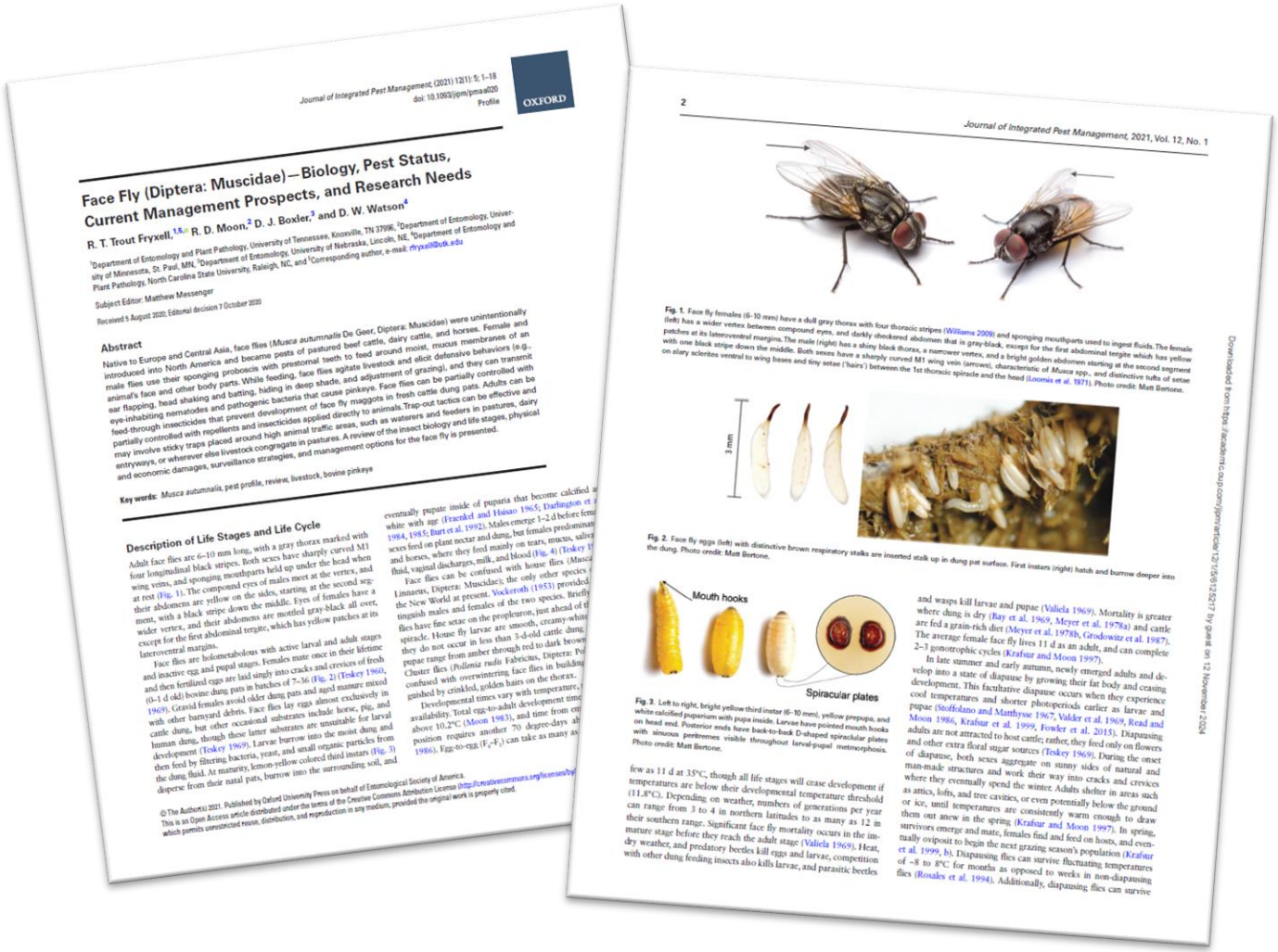
Pest species presented are a little **poultry heavy** (apologies, poultry IPM is just *really cool!*)



Methods will help with pests in **many scenarios**!

[Link to livestock factsheets]

Special Collection (2021): IPM of Fly Pests in Animal Agriculture



Face Fly (Diptera: Muscidae)—Biology, Pest Status, Current Management Prospects, and Research Needs

R. T. Trout Fryxell, R. D. Moon, D. J. Boxler, and D. W. Watson

Journal of Integrated Pest Management, 2021, Vol. 12, No. 1

Overview

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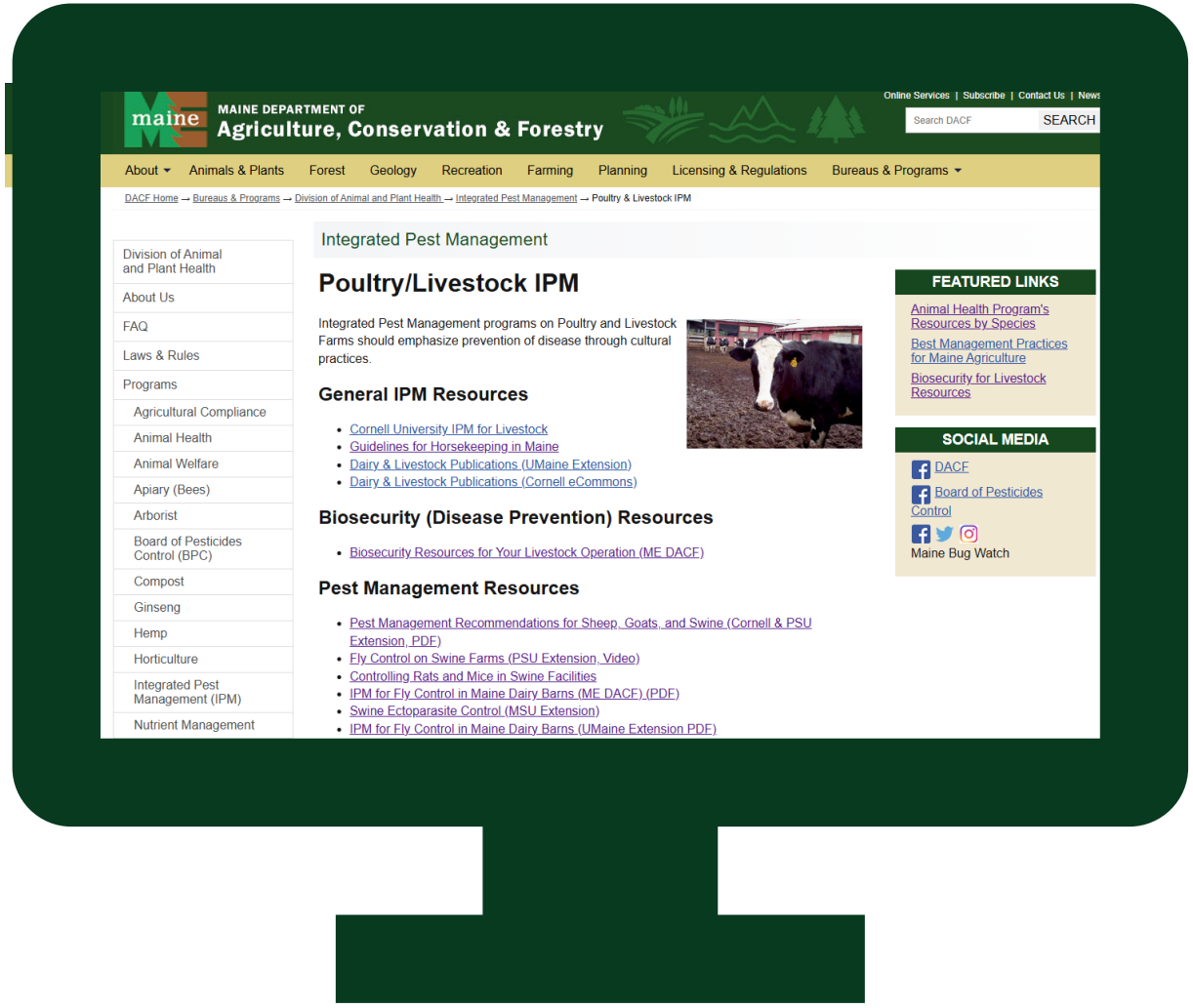

Special Collection (2021): IPM of Fly Pests in Animal Agriculture

What is integrated pest management?

Identification

- Proper identification of pest
- Understanding the system where the pest exists

Prevention, Cultural & Mechanical Control

- Prevent and control through physical means
- Set your location up for success

Monitoring & Recordkeeping

- Monitor in a tracked and systematic way
- Make it useful for the future!

Action Thresholds

- What is the population level?
- What methods are needed at this level?

Biological and Pesticide Control

- Dynamic and flexible as methods change

IPM is the standard, and many institutions are involved

The IPM Cycle

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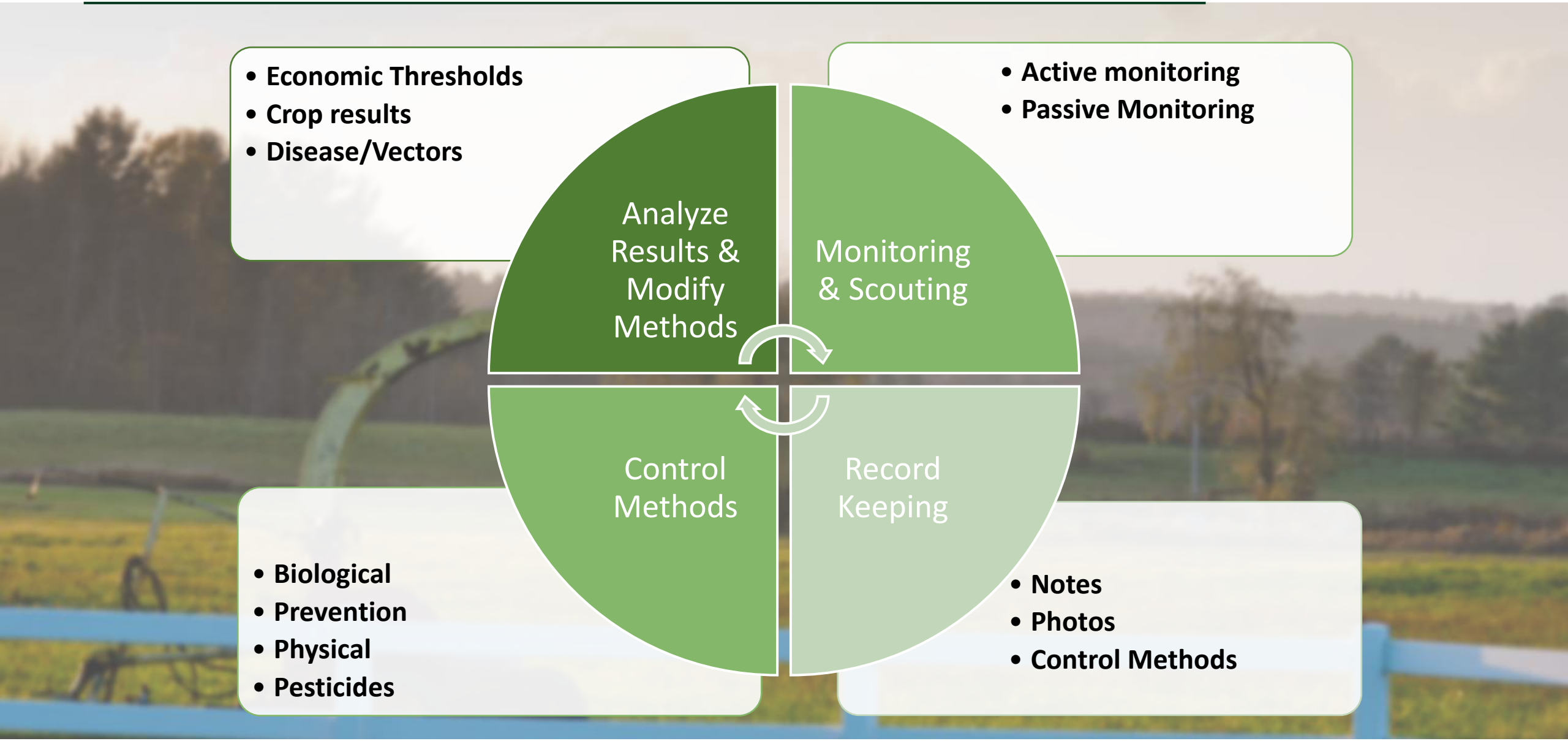

Pests, Poultry & Livestock – not a good mix!

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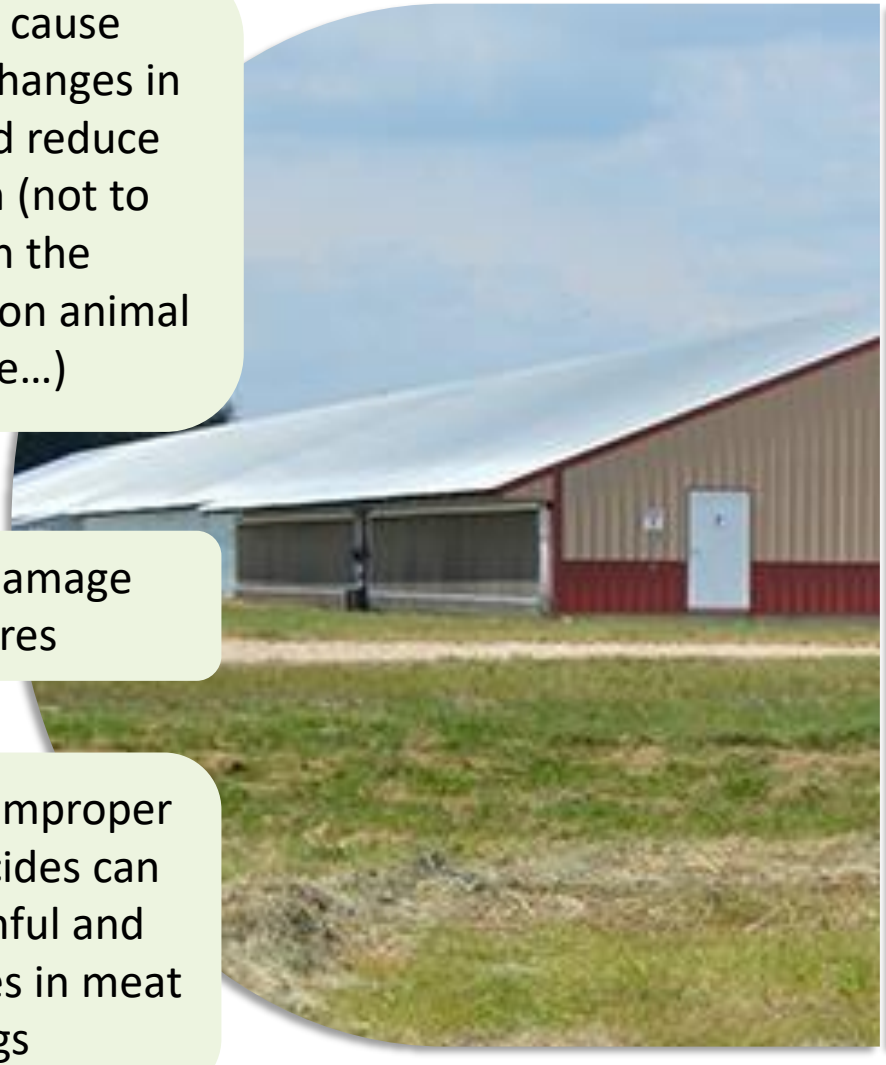
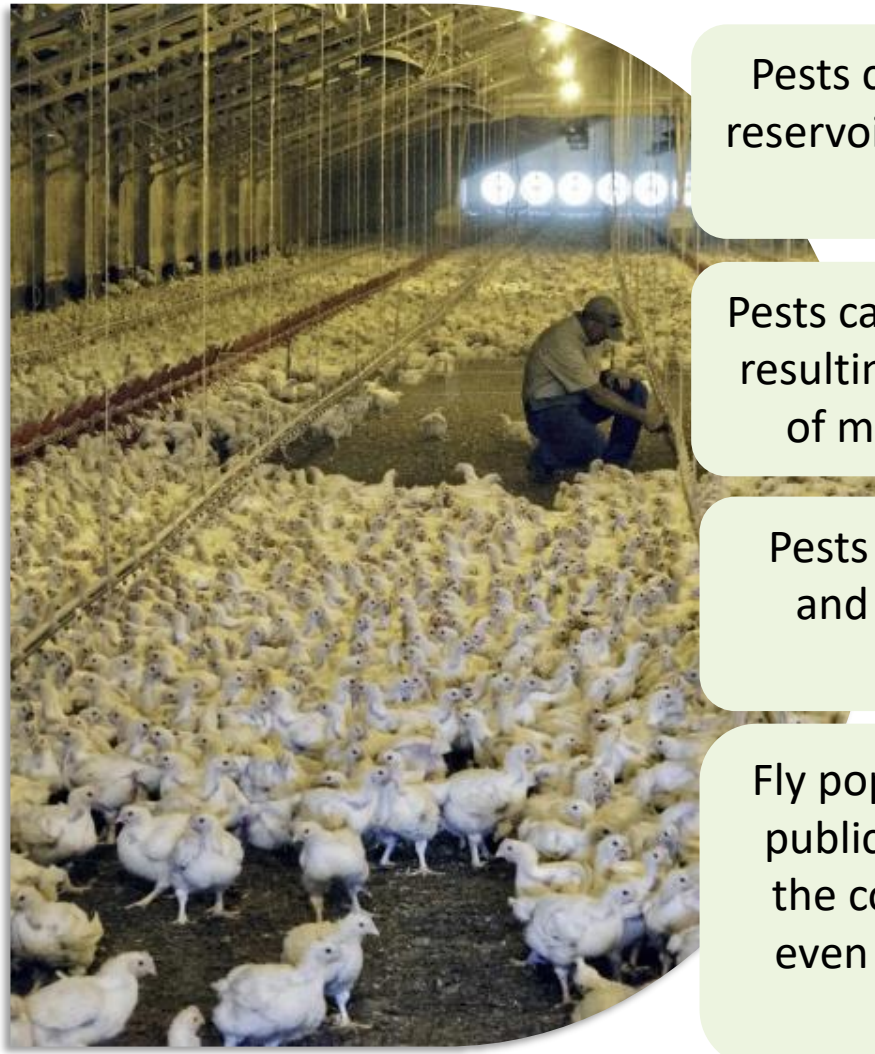
Pests can cause behavioral changes in animals and reduce production (not to mention the implications on animal welfare…)

Pests can damage structures

Excessive or improper use of pesticides can create harmful and illegal residues in meat or eggs





Pests can serve as disease reservoirs and make animals sick

Pests can reduce production resulting in less production of milk, eggs, and woll

Pests can annoy workers and create frustrating logistics

Fly populations can create public health nuisance in the community, and can even result in threats of litigation

Photos: Outside Farm; Inside Farm;

Rodent Problems: Poultry Facilities and Barns

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Can attract foxes, raccoons, and other chicken predators

Ideal rodent habitat – harborage, food, water

Consumes AND contaminates feed

Prefers feed to baits

Gnaw on structural, mechanical, and electrical utilities

Weakens concrete slabs and walkways

Photos: Source: *Purdue Factsheet; Outside Farm; Inside Farm; Mouse in Feed; Rats with Eggs; Fox*

2023 Ag Trades Presentation on Farm Rodent IPM

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House Fly (*Musca domestica*)

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Adults

- Live 3-4 weeks on average
- Most active during the day
- Females can produce 6 batches of eggs every 3-4 days (75-200/batch)

3-4 days

Eggs

- Eggs laid in manure, spilled feeds, and any moist warm decaying organic material
- **Manure must be moist!!!**

12-24 hours

10-45 day life cycle

Larvae

- Feed on substance they are laid in
- Go through three instars

4-7 days

Pupae

- Hardened case formed from larval skin (puparium)

Generations overlap and all stages are present at the same time (indoors)

Key Problems

- Complaints from neighbors
- Possible legal action
- Disease threats
- Major pest of poultry, sheep, goats, and swine

Sources: Pest Management Recommendations for Poultry; IFAS Factsheet; 2021 Review Paper on House Flies; Photos: Jim Kalisch and Jerry F. Butler

House Fly (*Musca domestica*) – Identification

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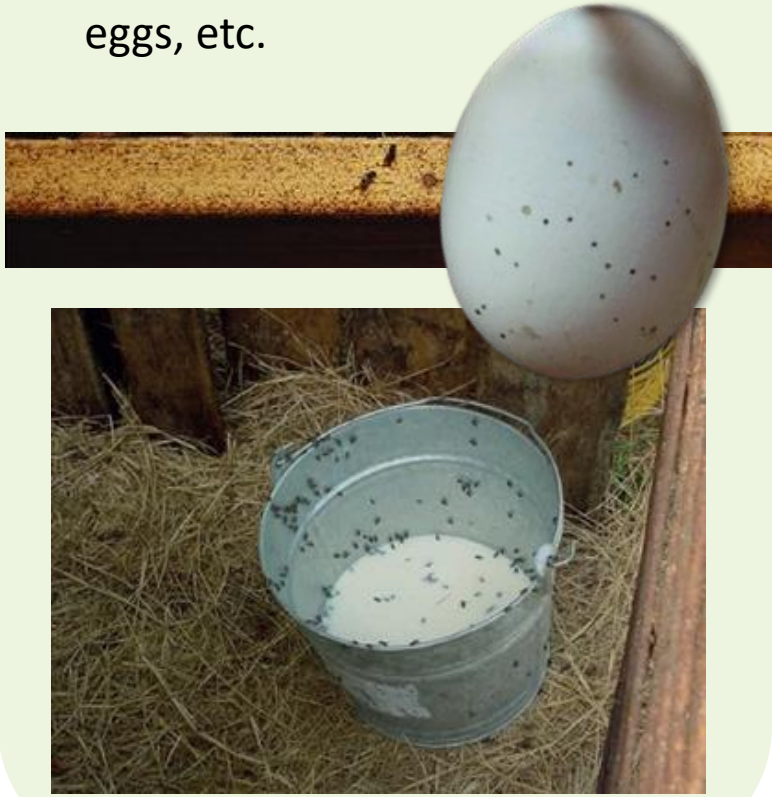
Identifying Flies

- Adults: ¼ inch long, dull gray, four black stripes
- Resting adults can be found:
  - inside on ceilings, walls, posts
  - outside beneath roof overhangs, on walls and fences

Other Evidence

- "Fly Specks" – regurgitated fluid and darker fecal spots on walls, eggs, etc.



Animal Behaviors & Problems

- Tapeworms in poultry
- Many illnesses in animals, including…
  - Porcine reproductive and respiratory syndrome virus in Swine
  - Necrotic enteritis (NE) in Poultry
  - Salmonellosis in cattle
  - Pigeon fever in horses

Sources: Pest Management Recommendations for Poultry , 2021 Review Paper on House Flies; Photos: Matt Aubuchon, Chris Gaden Erika Machtinger

Little House Fly (*Fannia canicularis*)

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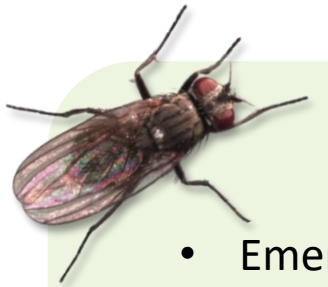

Adults

- Emerge in large numbers in early spring with a second peak in the fall

Eggs

- Laid in organic matter – excrement from poultry, cattle, humans
- **Manure must be moist!!!**

36-48 hours

Larvae

- Feed on organic matter
- Development depends on manure conditions and temperature

8+ days

Pupae

- Hardened case formed from larval skin (puparium)

~8 days

18-22 day life cycle

Typically associated with litter-covered floors & open window ventilation

Key Problems

- Can be a nuisance to neighboring properties
- Pest of poultry

Sources: Pest Management Recommendations for Poultry; IFAS Factsheet; 2021 Review Paper on Little House Flies; Photos: Stephanie Leon, Alec Gerry

Little House Fly (*Fannia canicularis*) – Identification

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Identifying Adults

- Look like house flies, but 2/3 the body length
- Less dark stripes
- Wings held over back at rest

Identifying Larvae

- Larvae are brown, flattened and spiny
- Resembles house fly, but smaller at 3/16th inch
- Three brown stripes on the thorax

Other Evidence

- Adults found resting on weeds, branches, or sides of buildings
- Adult males hover indoors
- Camouflaged larvae in manure
- Complaints from neighbors

Animal Behaviors & Problems

- Potential vectors for:
  - Newcastle disease virus
  - Aleutian mink disease virus
  - Several bacteria
  - Rare cases of ear, urinary tract, intestinal, or auricular myiasis in humans

Sources: ***Pest Management Recommendations for Poultry*** ***Photos: Stephanie Leon, Caleb Hubbard***

Stable Fly (*Stomoxys calcitrans*)

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Adults

- Feed on blood, biting warm-blooded animals
- Lower legs of cattle, horses, and ears of dogs
- Also feed on nectar and sugar

12-24 hours

Eggs

- Each female can lay up to 800 eggs

~7 days

~19-22 day life cycle

Pupae

- Pupate in same substrate as development

10-11 days

Larvae

- Three larval instars
- Develop in fermenting plant material mixed with animal waste, but flexible!

Stable flies are blood feeding and bite animals and humans

Key Problems

- One of the most damaging pests for the dairy industry
- Reduced milk production
- Decreased weight gain in beef cattle
- Bite humans and companion animals

Sources: IPM For Fly Control in Maine Dairy Barns, Review Paper on Stable Fly Management (2020), Biology and Management Paper (2021); UF Extension; Photos: Rochon et al. 2021, Lyle Buss

Stable Fly – Identification

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Identifying Adults

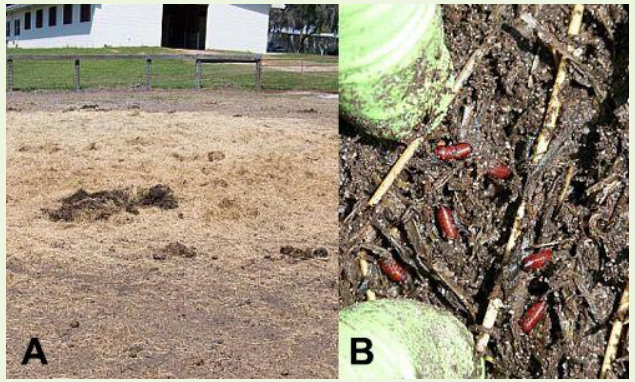
- 4-7mm in length
- Gray in color
- Dark reddish-brown piercing sucking mouthpart
- Two pairs of broad dark thoracic stripes
- Rest with wings partially spread

Identifying Larvae

- White with black rounded spiracles on the back end

Other Evidence

- Fresh (1-3 week) horse feces are very attractive for egg laying
- Typically, one population peak in midsummer
- Proximity to other potential habitats within one mile – decomposing crop residues



Animal Behaviors & Problems

- Infestations can exceed 1,000 flies per animal (>1L blood per day!!!)
- Reduced weight gain and feed efficiency in beef feeder calves
- Behaviors:
  - Bunching
  - Tail flicking
  - Skin twitching
  - Leg stamping
  - Indoors – bunching towards middle of barn

Sources: IPM For Fly Control in Maine Dairy Barns, Review Paper on Stable Fly Management (2020), Biology and Management Paper (2021); Photos: Lyle Buss, Philip Kaufman

Face Fly (*Musca autumnalis*)

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Adults

- Feed around moist mucus membranes
- Also feed on plant nectar and dung

Eggs

- Laid into cracks and crevices of fresh dung pats
- Only cattle dung is suitable for development

192 degree-day life cycle above 50F

Larvae

- Feed on bacteria, yeast, and organic particles in dung

Pupae

- Pupate in surrounding soil
- Puparia becomes white with age

In northern climates, typically 3-4 generations per year

Key Problems

- Pests of pastured beef cattle, dairy cattle, and horses
- Behavior changes
- Eye nematodes
- Pinkeye

Sources: 2021 Review Paper on Face Flies; Photos: Matt Bertone

Face Fly – Identification

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Identifying Adults

- 6-10mm long
- Gray thorax with four black stripes
- Sponging mouthparts

Identifying Larvae

- 6-10mm long
- Bright yellow third instar larvae
- Pointed mouth hooks on head end

Other Evidence

- Diapausing adults aggregate on sunny sides of structures
- Overwinter in attics, lofts, tree cavities

Animal Behaviors & Problems

- Defensive behaviors:
  - Ear flapping
  - Head shaking
  - Hiding in shade
  - Grazing adjustments
- Pathogens:
  - Brucellosis
  - Eyeworms
  - Green-muscle disease
  - Mastitis
  - Pinkeye
  - Allergens

Source and Photos: 2021 Review Paper on Face Flies;

Lesser Mealworm / Darkling Beetle (*Alphitobius diaperinus*)

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Adults

- Found in manure or litter
- Feed on damp and moldy grain
- Live 3-12 months

Eggs

- Laid in cracks and crevices in manure or litter

3-6 days

Larvae

- Develop in 5-9 instars (longer development at lower temps)
- Bore into wood posts, beams, paneling, drywall, insulation

depends

Pupae

- Pupation in:
  - drier areas of the manure or litter
  - Cracks/crevices

3-10 days

42-97 day life cycle

Life cycle makes control difficult - many stages in the wood...

Key Problems

- Structural damage
- Vector of poultry disease
- Public nuisance

Sources: Pest Management Recommendations for Poultry; UF Extension *Photos: James Dunford*

Lesser Mealworm / Darkling Beetle – Identification

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Identifying Adults

- Dark brown or black
- ¼ inch long
- Not observed in high numbers before 20-24 weeks of manure accumulation

Identifying Larvae

- Wireworm-like
- Yellowish brown
- Up to ¾ inch long

Other Evidence

- Focus search in areas with spilled grain
- Increased energy costs
- Small round holes (~ ¼ inch) in wood posts, beams, paneling, drywall, insulation

Animal Behaviors & Problems

Vectored diseases:

- acute leukosis (Marck's disease)
- fowl pox
- Numerous pathogenic *Escherichia coli* serotypes
- Several *Salmonella* species
- tapeworms

Sources: Pest Management Recommendations for Poultry; UF Extension ***Photos: James Dunford***

Hide Beetle (*Dermestes maculatus*)

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Adults

- Scavengers: bird carcasses, skins, feathers, dead insects and more
- Live 60-90 days

6-15 days

Eggs

- Laid on manure and litter surfaces

2-7 days

XX day life cycle

Larvae

- On average seven instars
- Typically remain in manure, but will migrate if needed

23-41 days

Pupae

- Bore into wood posts, beams, paneling, drywall, and insulation to pupate

Pile and tarp removed manure to prevent spread

Key Problems

- Structural damage
- Vector of poultry disease
- Public nuisance: dispersal into the community at cleanout time

Sources: Pest Management Recommendations for Poultry; University of Florida; Photos:

Hide Beetle – Identification

Identifying Adults

- Dark brown on top with white underside
- 1/3 inch long

Identifying Larvae

- Same coloration
- Thickly covered with hairs
- ½ inch long

Other Evidence

- Scavenge on bird carcasses, skins, hides, feathers, dead insects, other animal and plant products
- Bore into hard surfaces to pupate, weakening structures
- Damage yellow pine, foam insulation, paneling, and drywall

Animal Behaviors & Problems

- Predominantly a concern for structures and nuisance during movement
- Difficult to control due to migration and varying life stages in wood structures

Sources: ***Pest Management Recommendations for Poultry*** ***Photos:***

Northern Fowl Mite (*Ornithonyssus sylvarum*)

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Adults

- Eight-legged

1-2 days

Nymph

- Eight-legged
- Two nymphal stages
- Only the first nymphal stage feeds

~9 hours

Larvae

- Six-legged
- Non-feeding life stage

2 days

Eggs

- 2-5 eggs laid after each blood meal
- Laid in the fluff of feathers

~7 day life cycle

While entire life cycle is on the bird, **can survive off bird 2-3 weeks**

Key Problems

- most important and common external parasite of poultry
- Up to 15% reduction in egg production
- Reduced fertility in males
- Reduced weight gain

Sources: Pest Management Recommendations for Poultry; University of Florida Photos: J.F. Butler

Northern Fowl Mite – Identification

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Identifying Mites

- Eight legs
- Dark red to black
- 1/26th inch

Animal Behaviors & Problems

- Blackened feathers and scabs in vent area of birds
- Look on vent, tail, back and legs of female birds
- Inspect entire male birds
- Anemia in heavily infested birds

Sources: Pest Management Recommendations for Poultry; University of Florida Photos: J.F. Butler

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IPM is the standard, and many institutions are involved

USDA

Northeastern IPM Center

maine MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

1865 THE UNIVERSITY OF MAINE Cooperative Extension

Monitoring & Recordkeeping

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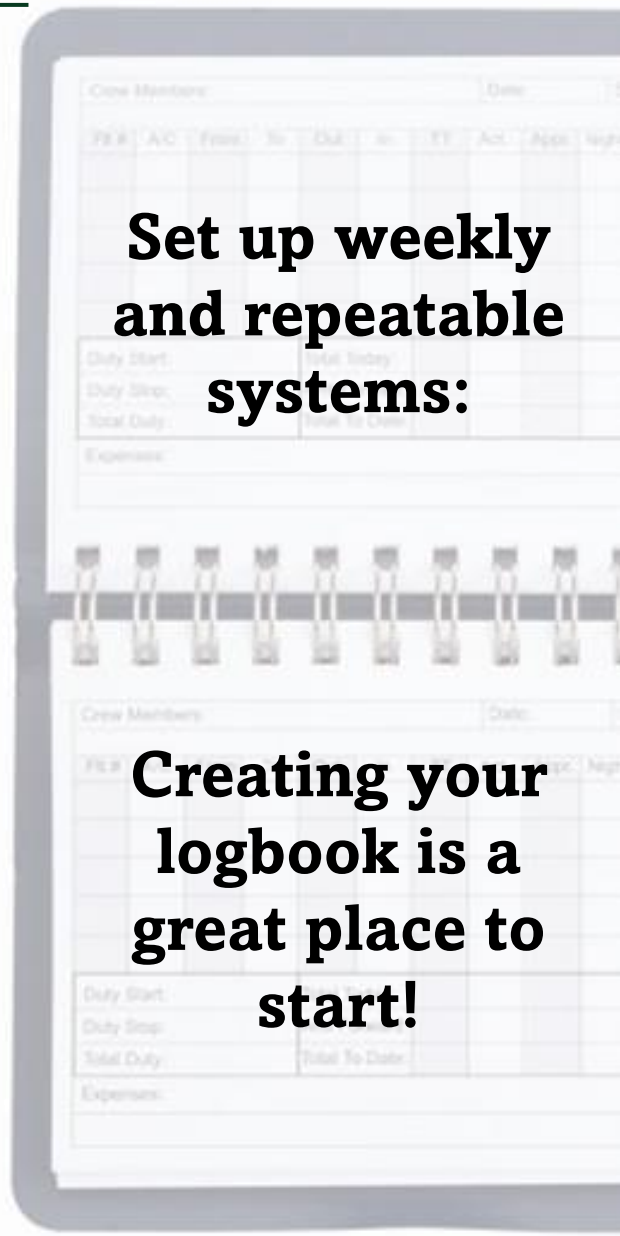
Date	Time	Initials	Crop Location	Observation Type	Description	*Many options…*

- **Visual scouting** – a big box to write in all pests seen or many columns with pest species
- **Passive Monitoring** – traps with unique identifiers, and columns with pest species
- **Control methods** – keep track of biocontrol releases, fertigation, watering, planting dates…etc.!



Set up weekly and repeatable systems:

Creating your logbook is a great place to start!

Monitoring & Recordkeeping

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Trapping 101

- Set up weekly systems and SOPs for monitoring.
- Label traps to match specific areas for spot treatments, keep traps in the same spot each week
- Use multiple traps and calculate averages for thresholds
- Pair traps with baits if needed.
- Position traps where pest activity is highest (e.g., near food or manure).
- Protect traps from weather and livestock interference.
- Check and replace traps regularly to keep data accurate.
- Remember: Traps are for data, not mass killing; and, all traps have biases…

This is one area I encourage DIY!

Monitoring & Recordkeeping

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Fly Populations in Poultry Houses

- **Baited-jug trap** – made from a gallon plastic milk jug with access holes, paired with commercial fly bait
  - Hang 3ft above floor equally around pit periphery
  - Average weekly count of 250 flies may indicate need for fly control

- **Sticky Fly Ribbons –** hang upstairs along aisles
  - May become too filled with flies and dust
  - Positioning is important; do NOT place near exhaust fans or light bulbs
  - Average weekly count of 100 flies may indicate need for fly control

- **Spot Cards –** placed in manure pit and fastened flush against surfaces
  - Count the number of fly specks weekly
  - Average weekly count of 100 spots may indicate need for fly control
  - Can be used to demonstrate long-term historical records

Method Targets

- House flies
- Little house flies

Sources: Pest Management Recommendations for Poultry; Photos: John Howell (CC BY-NC 2.0)

Monitoring & Recordkeeping

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Stable Flies

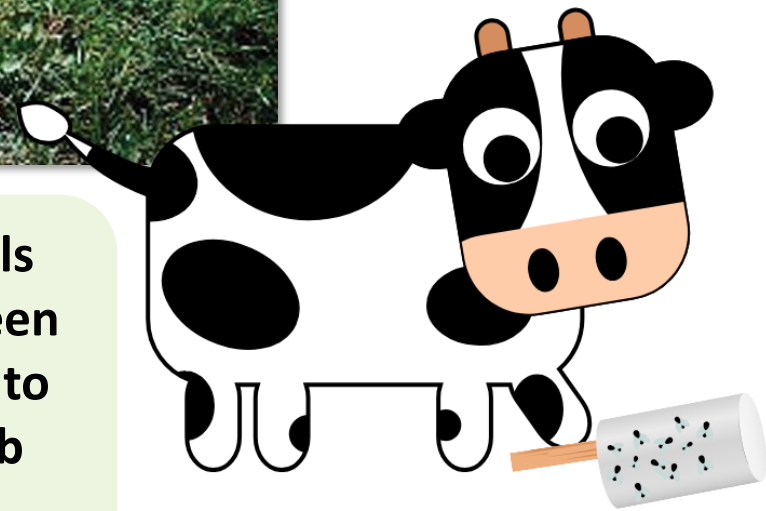
- **Fly Counts on Cattle** – leg counts; each counted fly represents 50-60 flies present in the vicinity
  - Typically, best during late morning or early afternoon
  - Economic threshold of 5 flies per leg or 15 flies per animal

- **Trapping –** the closer to the host animal the better
  - Sticky traps made from Alsynite fiberglass (e.g. Olson Trap)
  - DIY adult traps with corrugated plastic materials (Aluma Panel, Coroplast), or blue polyethylene screens covered with transparent sticky film
  - Pupal trapping – DIY with ¼ inch hardware cloth filled with wood chips
  - Adult emergence traps – cages placed over substrate to capture

- **Substrate Sampling –** for larvae
  - Core samples (not deep – most larvae in top 5cm)
  - Trowel sampling for presence/absence

Method Targets

- Stable Flies



Animals have been known to disturb traps…

Sources: IPM For Fly Control in Maine Dairy Barns, Review Paper on Stable Fly Management (2020), Biology and Management Paper (2021); Photos: Arbico Organics

Monitoring & Recordkeeping

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Fowl Mites

- **Regularly Monitoring Flocks –** imperative to inspect and catch mites at low population levels
  - 10 randomly selected birds from each cage row in entire house monitored weekly
  - Note location, age of bird, type of bird house

Method Targets

- Northern Fowl Mites

The following index is effective for estimating infestation levels:

0 = no mites observed	6 = 301 to 999 mites
1 = 1 to 2 mites	7 = 1,000 to 3,000 mites
2 = 3 to 9 mites	8 = 3,001 to 9,999 mites
3 = 10 to 31 mites	9 = 10,000 to 32,000 mites
4 = 32 to 99 mites	10 = more than 32,000 mites
5 = 100 to 300 mites	

An average index of 5 or greater for all examined birds generally indicates the need for chemical treatment.

Sources: Pest Management Recommendations for Poultry; UF Extension; Photos: J.F. Butler

Prevention, Cultural & Mechanical Control

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Think Clean! Think Dry!
The basics before we dig in…

- Clean on a regular basis
- Keep ventilation working
- Keep feed off the ground and dry
- Weed whacker and mower – weeds contribute to a lot of problems
- Dispose of mortalities and afterbirth immediately
- Clean hard to reach areas
- Clean equipment (like manure spreaders) as often as possible
- Fix water leaks

Prevention, Cultural & Mechanical Control

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Piling and Tarping Removed Manure (Warm Months)

- Prevent the spread of fly and beetle dispersal
- Manure must be completely sealed and placed in sunlight
  - Many ways to achieve this – e.g. pvc pipes filled with sand
- When removing tarp, do not inhale gas
- Minimum of two weeks, then spread on fields
- Does not seem to significantly affect nutrients in manure (link)

Method Targets

- House flies
- Little house flies
- Hide beetles
- Lesser mealworm

Sources: Pest Management Recommendations for Poultry; MSU Extension; Delaware Nutrient Management Commission; Photos: Virginia Cooperative Extension,

Prevention, Cultural & Mechanical Control

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Piling and Tarping Removed Manure (Warm Months)

A note on tires – unfortunately, breeding habitat for mosquitos that carry diseases

Sidewall slicing could be an opportunity here in Maine, there has been a [new program launched in Vermont]

Method Targets

- House flies
- Little house flies
- Hide beetles
- Lesser mealworm

Sources: Pest Management Recommendations for Poultry; MSU Extension; Delaware Nutrient Management Commission **Photos: Delaware Guide; Vermont**

Prevention, Cultural & Mechanical Control

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Sidewall Slicing

Sources: Pest Management Recommendations for Poultry; MSU Extension; Delaware Nutrient Management Commission Photos: Delaware Guide; Vermont

Prevention, Cultural & Mechanical Control

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Manure Management & Facility Upkeep

Poultry

- Fly breeding occurs in the manure under slatted floors (feeders and waterers)
- Aim for dry manure (50% moisture or less)
  - Reduces suitability for fly eggs
  - Increases suitability for beneficial predators and parasitoids
- Repair leaking waterers, condensation (check overhead water lines), improve ventilation using exhaust fans, drying fans, and proper insulation
- Inspect ventilation systems for debris frequently
- In-house composting may work for some situations, review this factsheet

The Poultry Manure Maneuver…

- Counterintuitive – it is better to allow manure to accumulate for beneficial populations to build
- Only remove manure in cooler months
- If it must be removed in warmer temps, pile and tarp it for a minimum of two weeks (instructions here)

Method Targets

- House flies
- Little house flies

Sources: Pest Management Recommendations for Poultry

Prevention, Cultural & Mechanical Control

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Move from the cleanest to the dirtiest space…

"Care should be taken to prevent contamination from the clothing of workers and various equipment, since mites can live for a few weeks off the host.

Sources: Pest Management Recommendations for Poultry

Prevention, Cultural & Mechanical Control

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Sanitation

Poultry

- Daily removal of dead birds, spilled seed, and broken eggs
- Mowing grass and weeds adjacent to poultry house
  - Air flow for fans
  - Reduced harborage for adult flies

Cattle

- Remove waste and spoiled bedding, ensure systems for adequate drying
- Thinly spread removed materials, harrow into soil, or compost
- Keep vegetation and animal waste apart
- Consider move round hay bale placement
- Avoid feed spillage

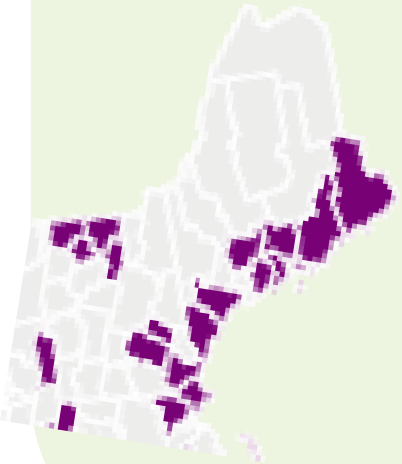
Method Targets

- Rodents
- House flies
- Little house flies
- Stable flies

Pest Management Recommendations for Poultry *Photos: Kathleen Tyler (CC by 2.0)*

Prevention, Cultural & Mechanical Control

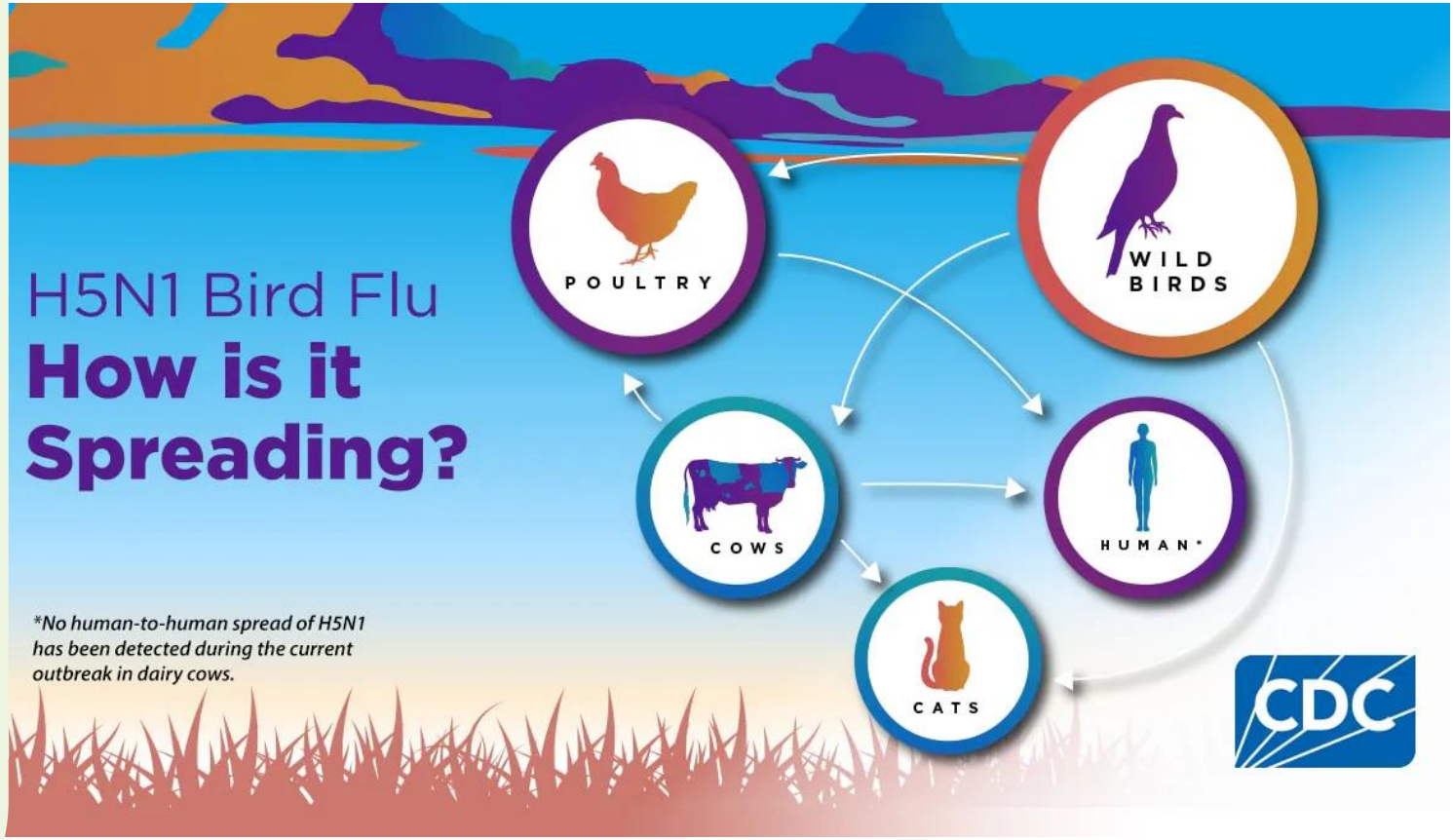
- H5 bird flu is widespread in wild birds worldwide
- Outbreaks in poultry and U.S. dairy cows
  - 50 states with outbreaks in poultry
- Several recent human cases in U.S. dairy and poultry workers



Poultry detections in Maine Counties (since 2022):

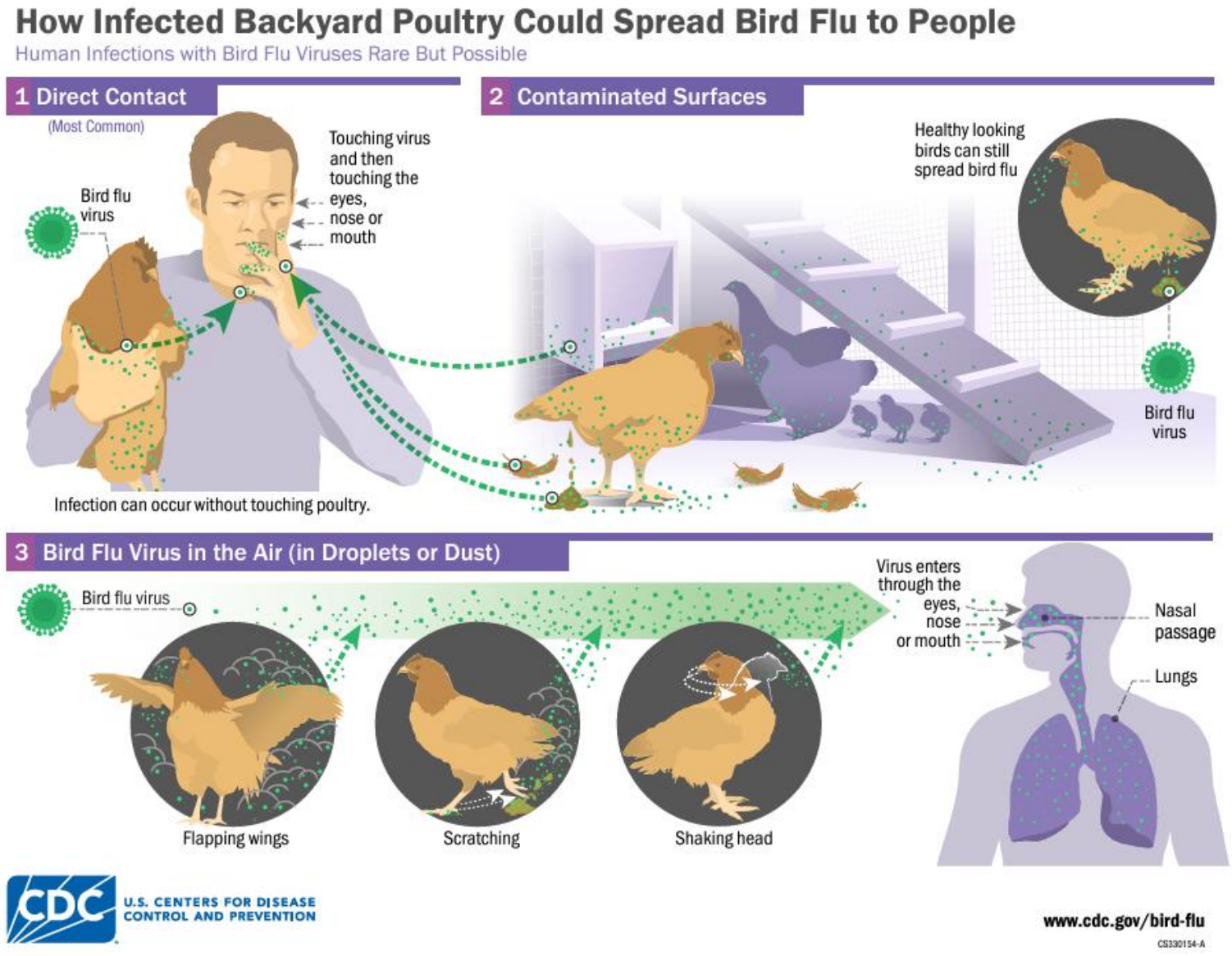
- Waldo
- Washington
- Cumberland
- Lincoln
- Knox
- Hancock
- Kennebec
- York

H5 Bird Flu - Poultry



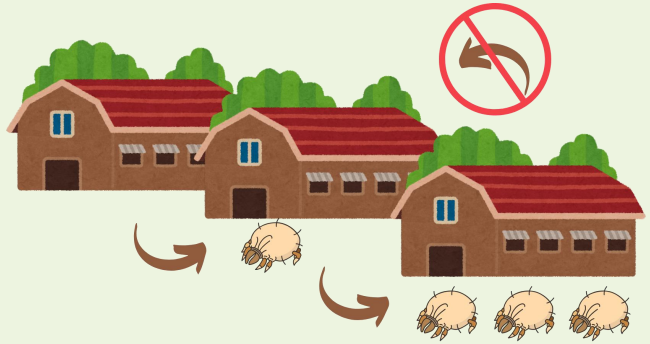
Source: CDC Situation Summary; Photos: CDC

Prevention, Cultural & Mechanical Control



H5 Bird Flu - Poultry

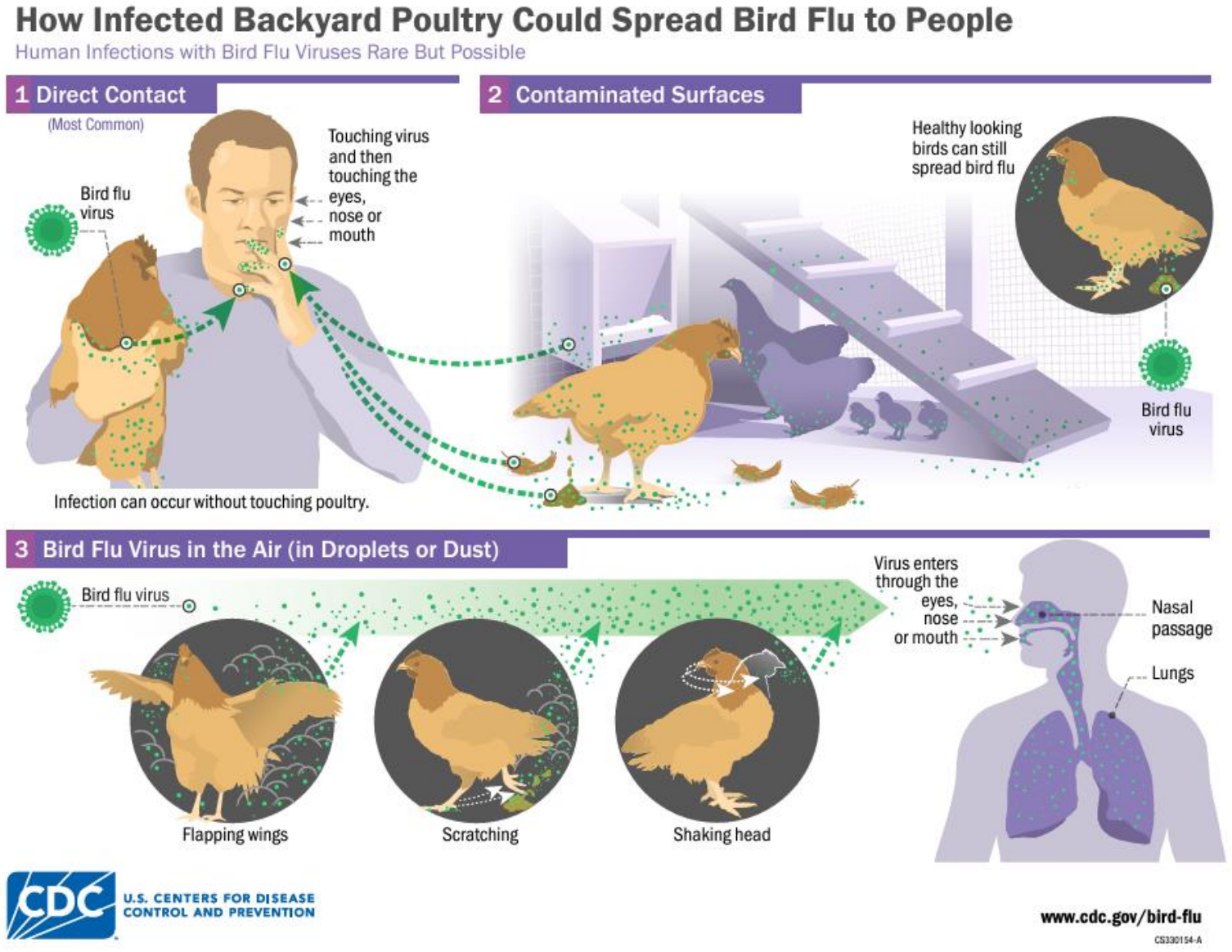
- Use a ventilation system that provides a constant supply of fresh air
- Strategically place fans to generate a clean-to-less-clean flow path of fresh air



- Regularly clean and maintain ventilation systems

Source: CDC Avian Influenza (Bird Flu) Resources

Prevention, Cultural & Mechanical Control



H5 Bird Flu - Poultry

"Personal protective equipment (PPE) should be worn when in direct or close contact (within about six feet) with sick or dead animals including poultry, wild birds, backyard bird flocks, or other animals, animal feces, litter, or materials potentially contaminated with HPAI A(H5N1) viruses"

Examples on following page

Source: CDC Avian Influenza (Bird Flu) Resources

Prevention, Cultural & Mechanical Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

H5 Bird Flu – Dairy Cows & Milking Parlor PPE

"A multistate outbreak of HPAI A(H5N1) bird flu in dairy cows was first reported on March 25, 2024. This is the first time that these bird flu viruses had been found in cows."

Source: CDC Situation Summary; CDC Avian Influenza (Bird Flu) Resources Photos: CDC

Prevention, Cultural & Mechanical Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

H5 Bird Flu – Administrative Controls

Watch for sick or dead animals on your farm or workplace and monitor animals for changes in feed consumption or production metrics.

Download and print free posters from CDC

Develop plans to monitor workers for illness

- Develop a process to communicate with your workers daily to determine if they are sick or have symptoms.
- Ask about conjunctivitis (pink eye), mild flu-like upper respiratory symptoms, or other symptoms consistent with avian influenza A virus infection.
- Designate management staff to maintain records for absenteeism, symptomatic workers, and testing. Review the records daily.

Source: CDC Situation Summary; CDC Avian Influenza (Bird Flu) Resources Photos: CDC

Biological Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

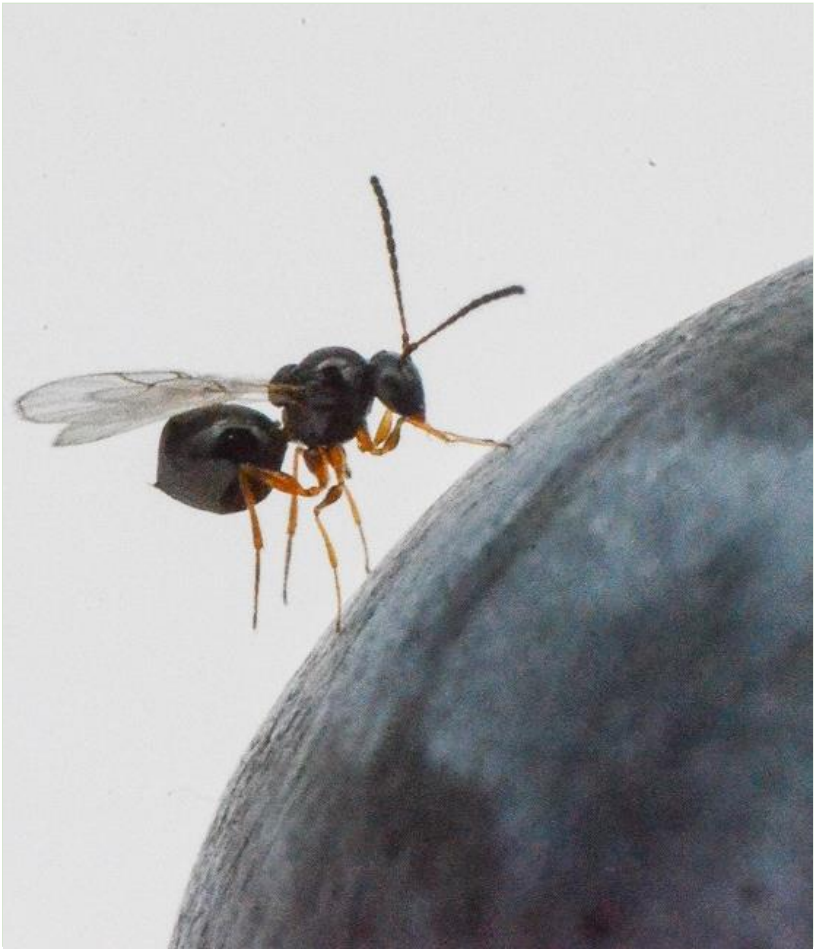
Often Insects or Other Non-Insect Arthropods		Entomopathogens		
Predators *e.g., rove beetles*	**Parasitoids** *e.g., larval parasitoids*	**Fungi** *e.g., Beauveria bassiana*	**Nematodes** *e.g., Oscheius onirici*	**Bacteria & Viruses** *e.g., Bacillus thuringiensis (Bt)*

Generalist → **Specialist**

Photos: Machi (iNaturalist); Tim Haye; Surendra Dara; Foye and Steffan 2019; Scimat

Biological Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Conservation Biocontrol	Augmentative Biocontrol	Classical Biocontrol
		

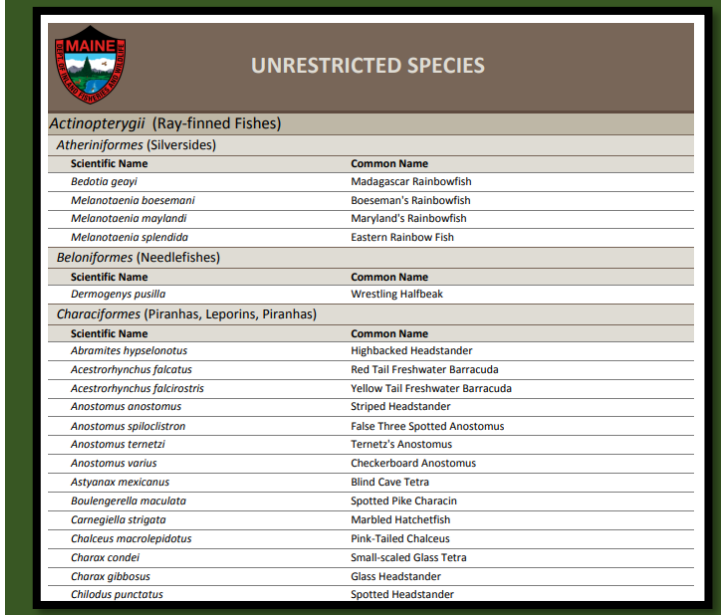
Photos: Sarah Foltz (Xerces.org); Victor Fursov; Tim Haye

Releasing Biocontrol Organisms in Maine

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Check the Maine Unrestricted List

"Maine law allows the Department to maintain a list of species of fish and wildlife, including tropical fish and invertebrates, which do not require an importation, exhibition, or possession permit"



UNRESTRICTED SPECIES

Actinopterygii (Ray-finned Fishes)

Atheriniformes (Silversides)

Scientific Name	Common Name
Bedotia geayi	Madagascar Rainbowfish
Melanotaenia boesemani	Boeseman's Rainbowfish
Melanotaenia maylandi	Maryland's Rainbowfish
Melanotaenia splendida	Eastern Rainbow Fish

Beloniformes (Needlefishes)

Scientific Name	Common Name
Dermogenys pusilla	Wrestling Halfbeak

Characiformes (Piranhas, Leporins, Piranhas)

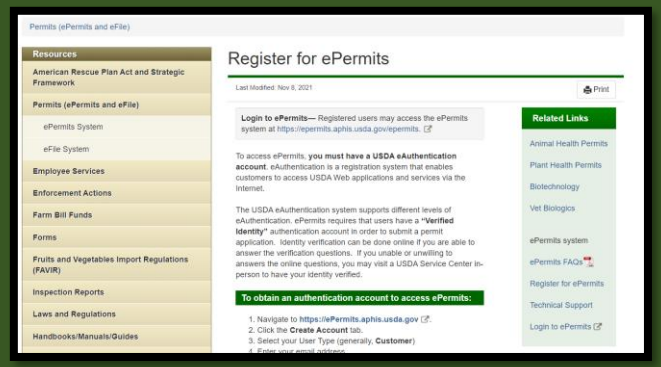
Scientific Name	Common Name
Abramites hypselonotus	Highbacked Headstander
Acestrorhynchus falcatus	Red Tail Freshwater Barracuda
Acestrorhynchus falcirostris	Yellow Tail Freshwater Barracuda
Anostomus anostomus	Striped Headstander
Anostomus spiloclistron	False Three Spotted Anostomus
Anostomus ternetzi	Ternetz's Anostomus
Anostomus varius	Checkerboard Anostomus
Astyanax mexicanus	Blind Cave Tetra
Boulengerella maculata	Spotted Pike Characin
Carnegiella strigata	Marbled Hatchetfish
Chalceus macrolepidotus	Pink-Tailed Chalceus
Charax condei	Small-scaled Glass Tetra
Charax gibbosus	Glass Headstander
Chilodus punctatus	Spotted Headstander

Link to the Unrestricted List

Link to Learn More

Get a permit from APHIS

"Under the authority of the Plant Protection Act of 2000, a Plant Protection and Quarantine (PPQ) 526 permit is required for the importation, interstate movement and environmental release of biological control organisms of plant pests and weeds."



Permits (ePermits and eFile)

Resources

American Rescue Plan Act and Strategic Framework

Permits (ePermits and eFile)

ePermits System

eFile System

Employee Services

Enforcement Actions

Farm Bill Funds

Forms

Fruits and Vegetables Import Regulations (FAVIR)

Inspection Reports

Laws and Regulations

Handbooks/Manuals/Guides

Register for ePermits

Last Modified: Nov 8, 2021

Print

Login to ePermits— Registered users may access the ePermits system at https://epermits.aphis.usda.gov/epermits.

To access ePermits, you must have a USDA eAuthentication account. eAuthentication is a registration system that enables customers to access USDA Web applications and services via the Internet.

The USDA eAuthentication system supports different levels of eAuthentication. ePermits requires that users have a "Verified Identity" authentication account in order to submit a permit application. Identity verification can be done online if you are able to answer the verification questions. If you unable or unwilling to answers the online questions, you may visit a USDA Service Center in-person to have your identity verified.

To obtain an authentication account to access ePermits:

1. Navigate to https://ePermits.aphis.usda.gov
2. Click the Create Account tab.
3. Select your User Type (generally, Customer)
4. Enter your email address

Related Links

Animal Health Permits

Plant Health Permits

Biotechnology

Vet Biologics

ePermits system

ePermits FAQs

Register for ePermits

Technical Support

Login to ePermits

Link to register for ePermits

Get a permit from the Maine Department of Inland Fisheries and Wildlife

MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE
353 Water Street, 41 SHS Augusta, ME 04333
Phone 207-287-5261

Wildlife Importation Permit Application
For Category 1 Restricted Species

In accordance with the provisions of the Revised Statutes, Title 12, Section 12152, 3-D.A. I hereby apply for a permit that allows me to import wildlife that is threatened or endangered, or that presents a risk to humans into the State.

Application Fee: $250
Permit Fee: $27

Name of Company/Facility: _____

Name of Owner/Manager: _____ **Date of Birth:** ___/___/___

Mailing Address: _____
(P.O. Box/Street/Apt#) (City/Town) (Zip Code)

Physical Address: _____
(Number, Street/Road Name/Apt#) (City/Town) (Zip Code)

Email Address: _____ **Phone Number:** (___) _____

List species you request to import below (***Please note:*** *you must provide a certification of veterinary inspection valid for the entire time animal(s) will be in the State, as well as other required documentation – see next page for details)*

Common Name	Scientific Name	Gender	Number

Do you possess a current Wildlife Exhibition Permit for the Category 1 Restricted Species listed above? ☐ Yes OR ☐ No

Date of Import: _____ **Import Method:** _____

Source (only one source per application): _____
(Name) (Address: Street, City, State, Zip)

Are species listed on CITES Appendix 1, or the USFWS Endangered Species list? ☐ Yes or ☐ No

Describe your experience handling species listed above: _____

Link to the Wildlife Importation Permit Application

Biological Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Macrochelid Mites (*Macrocheles muscae domesticae*)

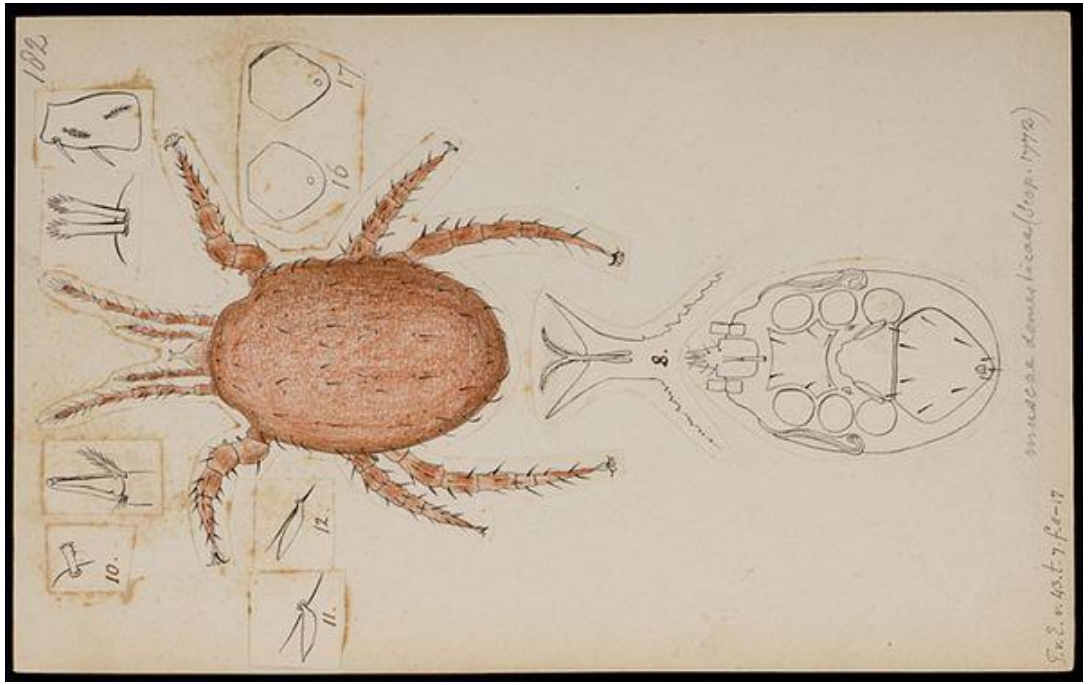
- Feeds on house fly eggs and first instar larvae
- Can be seen on the outermost layer of manure
- Can **substantially** reduce fly populations
- Mites require 3-4 weeks of manure accumulation to establish

Uropodid Mites (*Fuscuropoda vegetans*)

- Feeds on house fly first instar larvae
- Feeds deeper in the manure than macrochelid mites
- Complements the activity of macrochelid mites

Method Targets

- House flies in Poultry houses
- Stable flies (not as well; Macrochelid only)



[Pest Management Recommendations for Poultry](#) ; Photos: Naturalis Biodiversity Center

Biological Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Hister Beetles

Carcinops pumilio

- 1/8th inch long small black beetle
- Adults and larvae feed on house fly eggs and first instar larvae
- Live in surface layers of manure
- Can take up to 6 weeks for populations to develop

Gnathoncus nanus

- Present in lower numbers than *C. pumilio*

Method Targets

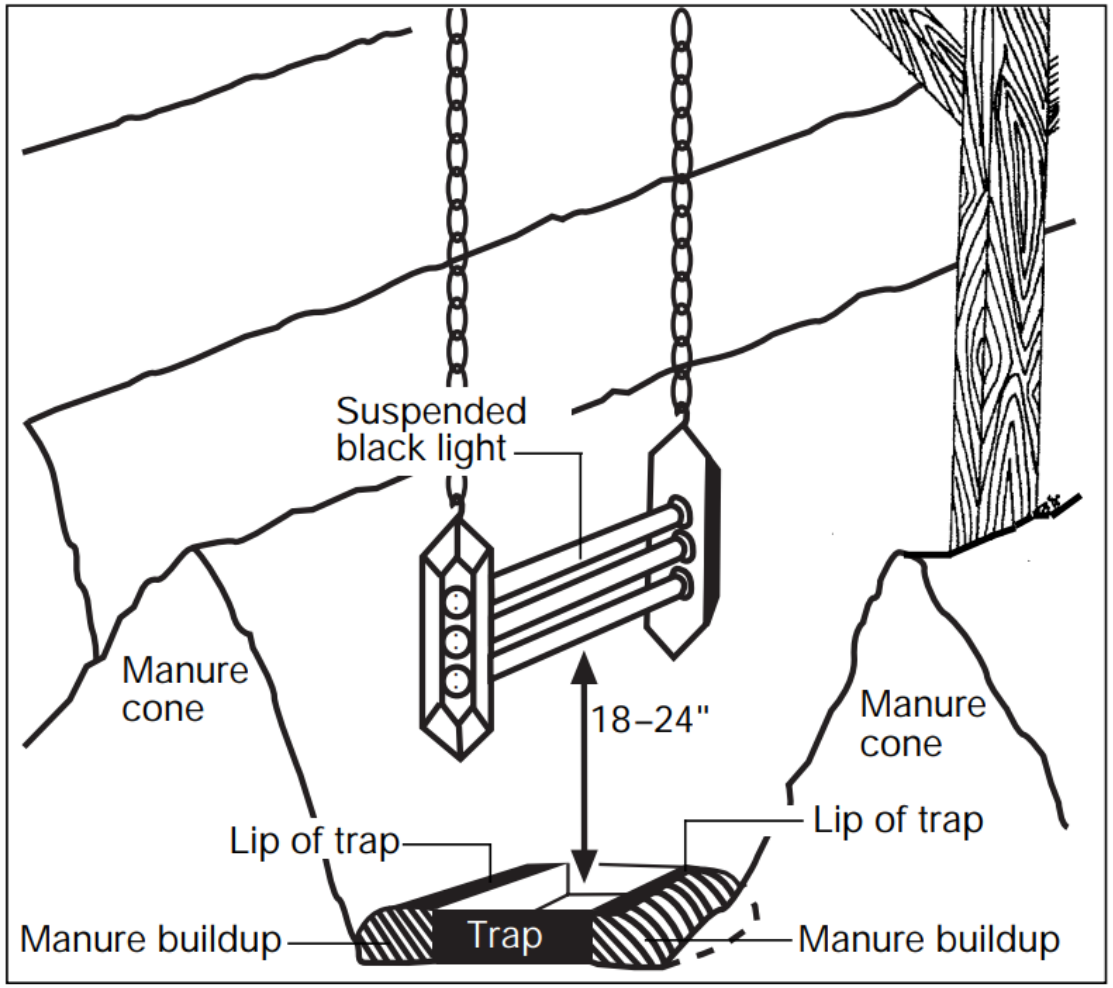
- House flies in Poultry houses

Pest Management Recommendations for Poultry ; UF Extension; Photos: Matthew R. Moore

Biological Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Hister Beetles: A unique opportunity for augmentative biocontrol!



Hister beetle traps and beetles can also be purchased from distributors, e.g. IPM labs

Method Targets

- House flies in Poultry houses
- Stable flies (less effective)

- Springtime – use blacklight to capture hister beetles as they go through natural dispersal behaviors
- Release into recently cleaned houses on the same farm

- Manure typically should be older than 24 weeks for a population of Hister beetles to be large enough to capture
- Transfer beetles immediately or store at 45-50°F up to 8 weeks, checking weekly

DO NOT transfer beetles from houses with known disease problems – beetles can carry several poultry diseases!

Pest Management Recommendations for Poultry ; UF Extension; Photo: Matthew R. Moore

Biological Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Muscidifurax raptor & M. raptorellis

- Tiny stingless parasitoid wasps – lay eggs inside developing fly puparium
- Occur naturally on many farms in low numbers
- Commercially available – work with insectary to ensure:
  - Climatically adapted to the release area
  - Understand release protocols
  - Select species and strains

Method Targets

House flies
Stable flies
Other Flies

TABLE 2. *M. raptorellus* release schedule for late spring and summer cleanout.

Week Post-Cleanout	Number of Parasitoids/Bird	Number of Pupae/Bird	Number of Colonies/ Bird House/Week*
1, 2	2/1	1/2	5
3, 4, 5	8/1	2/1	20
6, 7, 8	4/1	1/1	10
9, 10	2/1	1/2	5
11+	if necessary	if necessary	—
			Total: 110 colonies

*One colony = 10,000 parasitized fly pupae

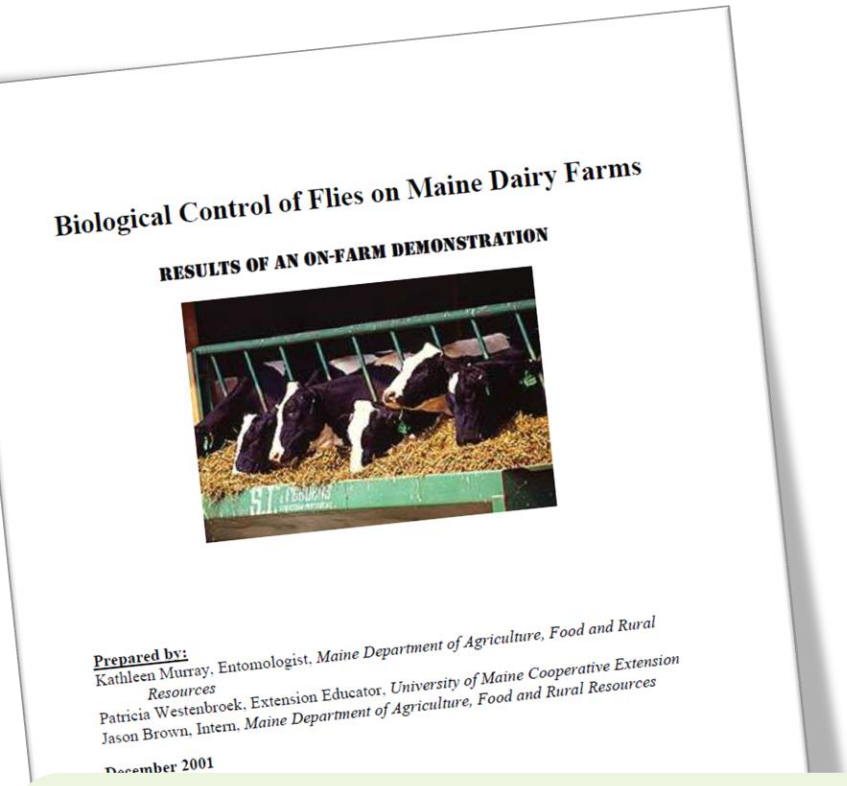
laying an egg in a fly puparium

Source: Pest Management Recommendations for Poultry ; UF Extension, NYSIPM Factsheet Photos: Lyle J. Buss

Biological Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Muscidifurax raptor & M. raptorellis


Biological Control of Flies on Maine Dairy Farms

RESULTS OF AN ON-FARM DEMONSTRATION

Prepared by:
Kathleen Murray, Entomologist, *Maine Department of Agriculture, Food and Rural Resources*
Patricia Westenbroek, Extension Educator, *University of Maine Cooperative Extension*
Jason Brown, Intern, *Maine Department of Agriculture, Food and Rural Resources*

December 2001

- 2001 study conducted in Maine
- Released weekly for 12 weeks
  - 10,000 wasps per week
  - Handfuls distributed in barns, including stall corners, under feed bunks and waterer, near fly breeding sites
- Monitored with sentinel fly pupae and by counting fly specks on masking tape
- Estimated cost of $216 per season (in 2001….)

Method Targets

House flies
Stable flies
Other Flies

“These results strongly suggest that the wasp release was effective in controlling a significant proportion of the house fly population in three of the five release locations…

This approach appears to be most effective when used in individual calf hutches or in barns with calf or heifer pens. It appears to be less effective in open barns housing milk cows.”

laying an egg in a fly puparium

Source: Biological Control of Flies on Maine Dairy Farms; Photos: Lyle J. Buss; Learn More: UF Extension, NYSIPM Factsheet

Pesticide Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

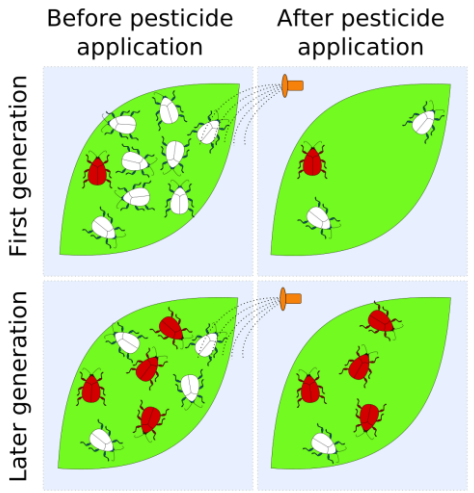
Poultry

- Use insecticides selectively to avoid killing beneficial organisms
- Adulticides and larvicides
- Considerations:
  - **Space sprays** – automated dispensing systems have been known to cause resistance problems
  - **Baits –** selective and can suppress low populations; do not allow birds to consume or scatter where parasitoids are present
  - **Feed Additives –** not recommended, severe resistance issues
  - **Larvicides –** only use for spot treatments

"Residual spray materials must be used sparingly and only as a last resort to control fly outbreaks that cannot be managed with other techniques."

Method Targets

- Flies in poultry houses



THE LABEL IS THE LAW!

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to any specific product.

Source: Pest Management Recommendations for Poultry

Pesticide Control

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Cattle & Stable Flies

- Insect growth regulators applied to removed waste and bedding
- Sprays on animals
- Indoor/Outdoor premise sprays
- Insecticide treated netting
- Ear tags are not effective – flies prefer legs, which are wet and dirty

Method Targets

- Stable flies

"Pyrethroid resistance in stable flies has been documented in several countries. In the United States, 3.5–12-fold resistance to permethrin was described in stable flies collected from Florida dairies and equine farms…"

THE LABEL IS THE LAW!

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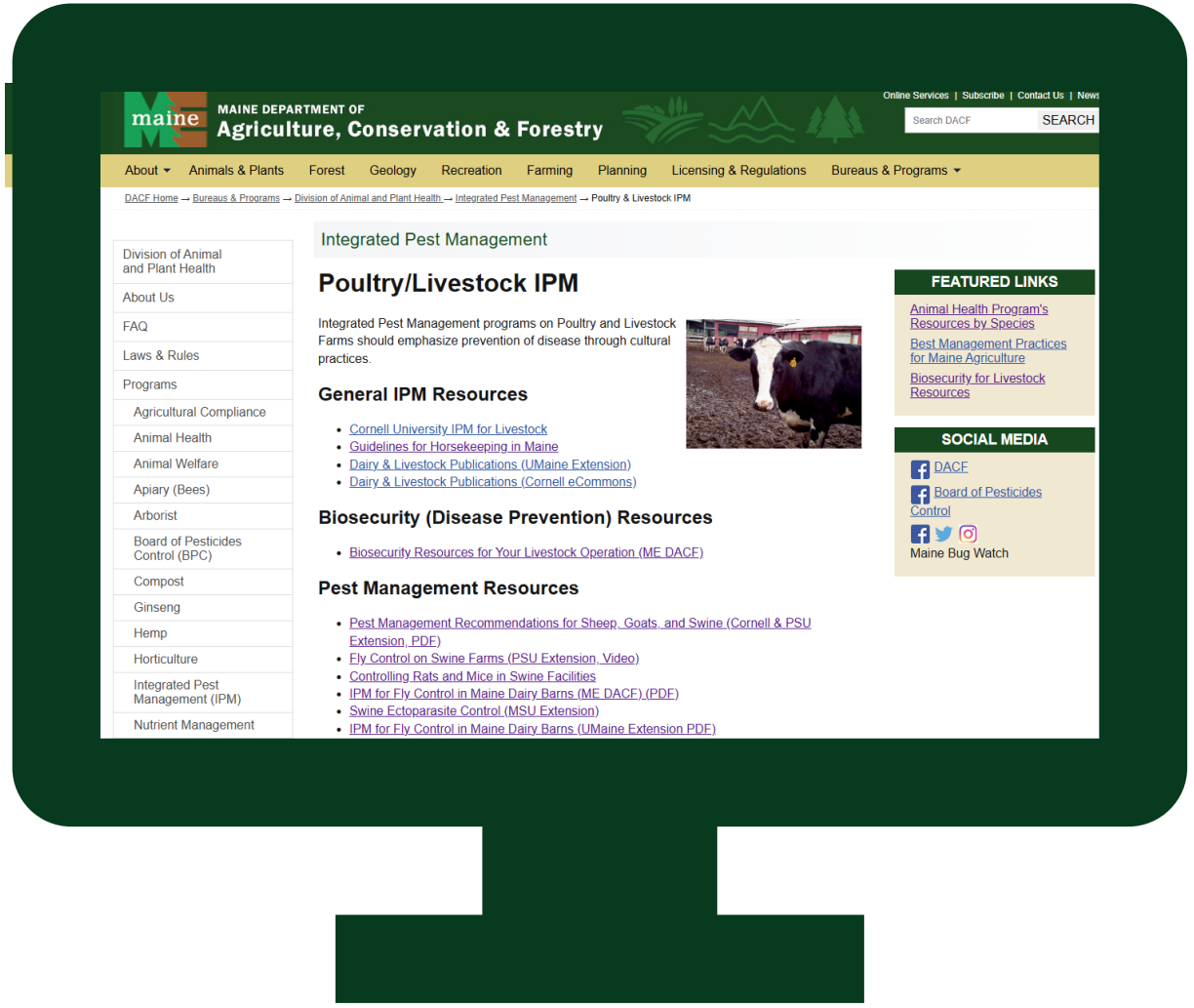
Source: Pest Management Recommendations for Poultry

Questions & Additional Resource Links



Source: [Pest Management Recommendations for Poultry]