**OUTLINE**

- WHAT ARE PESTS
- IPM: WHAT IS IT AND WHY USE IT

**ASSORTED PESTS of PUBLIC HEALTH CONCERN**

**COMMENSAL RODENTS**
- ROACHES
- FLIES
- BED BUGS

**PESTS**

A pest is considered to be anything that:
- Injures humans, animals, crops, structures, or possessions.
- Competes with humans, domestic animals or crops for food, feed, or water.
- Spreads disease to humans, domestic animals, or crops.
Pests can be placed into four main categories

- Insects and related arthropods
- Plant diseases
- Weeds
- Vertebrates

Today we will limit our scope to Rats (vertebrates), Roaches, Flies and Bed Bugs (insects).

IDENTIFICATION

Bed bug vs. Spider beetle

The first step in any pest control program is correct identification whether it is an arthropod, rodent or other pest, or perhaps it is not a pest at all.

SOMETIMES A PEST IS AN ORGANISM IN THE WRONG PLACE
SOMETIMES ITS JUST A PEST
Once we know which pest we are dealing with, we must choose a strategy.

- OPTION A  "Older traditional" CONTROL STRATEGY
- OPTION B  AN "IPM" CONTROL STRATEGY

“Traditional” PEST CONTROL
- Can be chemical intensive
- Reactive to pest outbreaks
- Less emphasis on prevention

“INTEGRATED PEST MANAGEMENT”
- Based on sound pest management principals
- Systematic program of long-term control
- Emphasis is on prevention
- Stresses modification of conditions that favor pests
- Pesticide use is limited in terms of types and amounts
SANITATION IS PEST CONTROL

PEST TRIANGLE

MECHANICAL MEASURES: Exclusion of pests by rodent proofing, caulking for roaches, screening for flies, improved sanitation, various insect & rodent traps addressing moisture issues.

CULTURAL MEASURES: Placing garbage out right before pickup, covering garbage cans, hanging up mops, not using wood for shelves, storing food in pestproof containers, stock rotation.

BIOLOGICAL MEASURES: Such as applying an insect growth regulator, stocking a lake with fish to control mosquitoes.

CHEMICAL CONTROL: The use of approved pesticides to control a target organism when threshold limits are reached.
Pest-Proofing with Sealants

**ELASTOMERICNESS**
The ability of a material to return to its original size and shape after being stretched or compressed

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**Perhaps A New Name But Not A New Concept**

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**THE RODENTS of NY**
**RODENT MEANS “TO GNAW”**

<table>
<thead>
<tr>
<th></th>
<th>House Mouse</th>
<th>Norway Rat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>0.4 - 1 oz</td>
<td>7 - 18 oz</td>
</tr>
<tr>
<td>Length</td>
<td>5 – 7 ½ inches</td>
<td>13 – 18 inches</td>
</tr>
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Rat Myth Buster

Do rats have back bones?

YES! Rats are vertebrates & mammals, just like us.

- Rodents make up one-third of the earth's total mammal population.
- Several types of rats and mice are found in the US. However, only the Norway rat, roof rat and house mouse are considered important pests.
- They are frequently referred to as "commensal rodents" because of their intimate relationships with humans.
- In urban New York we are principally concerned with the Norway Rat and the House Mouse.

The Norway rat is primarily a burrowing animal but it can climb when necessary. It prefers to live in a burrow 8 to 18 inches below ground.
Also called the sewer rat, wharf rat, or brown rat. Range was thought to be 100-150' but recent research has found that 90-400' is a more accurate range.
The House Mouse
The house mouse depends less on humans than rats do. But on the other hand, they adapt well to living with humans. The house mouse has a smaller range. Home range tends to be from a few feet up to 30 feet. Mice, unlike rats, show little fear of new objects. 

Warmth plays an important role in mouse behavior.

RODENT THREATS
Rat burrowing can cause streets and structures to collapse which can cause damage and personal injury as well. Their constant gnawing causes extensive damage to property along with the possibility of rodent bites to humans and animals. They are responsible for power outages, internet blackouts and fires, perhaps 20 percent of fires attributed to “unknown causes” are caused by rodents gnawing on gas & electrical lines.

How People Are Exposed
1) Contamination of food and products
2) Inhalation of:  
   - Droppings & urine  
   - Mouse allergens in the home
3) Skin contact  
   - Rat bites
THE BLACK DEATH

Between 1347 - 1352, over 25 million people died of “THE PLAGUE” a disease carried by rats and transmitted to humans by fleas.

A Few Diseases Spread by Rats and Mice

- Leptospirosis, Rats; eating food or drinking water contaminated with rodent urine.
- Lymphocytic Chorio-meningitis (LCMV) House Mouse; breathing in dust that is contaminated with rodent urine or droppings.
- Rat-Bite Fever Rats & possibly mice; bite, scratch or contact with a dead rodent.
- Eating or drinking food or water that is contaminated by rat feces
- Salmonellosis Rats & mice; eating or drinking food or water contaminated by feces
- Hanta – Virus Inhalation of bacteria from Mouse urine & Feces
- Rickettsialpox From Mice; Bite from an infected mite

Additional Concerns

- Allergen exposure to fur, urine and feces.
- Many inner-city children become sensitized to rodent allergens and may develop asthma.
- Rodents can transport a ectoparasites, such as mites and fleas.
- In the past ten years an average of 134 rodent bites per year have been reported to NYCDHMH PCS.
VARIOUS VIBRISSE TRIGGER DIFFERENT RESPONSES SUCH AS BURROWING
RODENTS ARE LINEAR BY BOTH BODY DESIGN & BEHAVIOR
THEY ARE ADAPTABLE AND OPPURTUNISTIC
THEY TAKES 20% OF WORLD FOOD STOCK BY CONSUMPTION AND CONTAMINATION
RODENT TERRITORIES ARE RESOURCE DEPENDANT
RATS HAVE A CEREBRAL PLAYBACK WHICH ENABLES THEM TO LEARN.
RATS ARE BEHAVIORALY MORE COMPLEX THEN WE HAD THOUGHT

Mice are considered to be the second most successful mammal and rats the third.
Mice and rats reproduce rapidly, as is generally the case with small animals. Their relatively short life spans, short gestation periods and rapid sexual maturity make effective rodent control critical. The reproductive cycle and number of rodent offspring increases with adequate food, water and harborage. They will reproduce year-round in stable environments with adequate food, water and harborage. House mice & Norway rats live approximately six to nine months.

**REPRODUCTION**

House Mouse Reproduction
Mice sexually mature and mate in as little as 5 - 8 weeks. Female mice reproduce up to 8 times in their lifespan, with litters averaging 4 to 7 pups. Therefore, a single female mouse may produce up to 56 offspring annually.

Norway Rat Reproduction
Norway rats can sexually mature and mate at 8 to 12 weeks. Norway rats average 8 to 12 pups per litter, averaging 4 to 7 litters per year. Therefore, a single female rat may produce up to 84 offspring annually.

They Keep Going and Going

Rodents like varied diets and are omnivorous & opportunistic.

#2 F O O D
What Rodents Eat

FOOD SHRAPNEL  25% OF PEOPLE LITTER
ADULT RATS REQUIRE 1 OZ OF FOOD PER DAY & 1-2 OZ WATER
MICE REQUIRE 3 GR. OF FOOD PER DAY.

* Both like a balanced variety of food.

Rats’ Food Preferences

- Rats will eat everything that people eat along with seeds and berries outdoors
- Garbage and food wastes (grease) provide rats with a nutritional diet that is essential to their reproductive health

DINING ALFRESCO
Dining Al Fresco

MOUSE FOOD PREFERENCES

Grains and seeds comprise a large part of most rodenticide baits, mice also are fond of snack foods which fall to hard to reach areas. Mice will drink if water is readily available but unlike rats, can metabolize moisture from the foods they eat. Mice snack around eating small amounts in several locations while rats tend to dine and eat larger portions.

URBAN RODENT FOOD SOURCES

1) Around, and in any of the street/city park garbage baskets prior to pickup;
2) Within each street storm water catch basins.
3) Among the plastic bags of trash placed out each evening directly onto the sidewalk by the thousands of food serving establishments.
4) In and around commercial refuse dumpsters.
5) Residential exterior alleys or indoor basement refuse compactor or storage rooms of both small and large multi-family housing.
6) In the gutter zone of the street/sidewalk area where the food and discard litter from the daily pedestrians occurs.
7) In and around parks upon those foods that remain as a result of pigeon feeding and upon uncollected fresh dog manure.
8) Refuse along the highway medians and embankments thrown from vehicles.
9) On subway and other rail tracks from discarded food litter.
Rodents like most pests arrive at a location in one of two ways, either as a captive or volunteer.

*Captives:* are introduced to a location usually by shipments or deliveries.

*Volunteers:* gain access through their own locomotion.

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**Identifying Rat Signs**

1. Feces/Urine (odor)
2. Rub Marks (Sebum from rodent fur)
3. Runways
4. Burrows in available earthen space
5. Gnaw Marks on wood or wires
6. Holes in walls.
7. Sightings
Looks like a dropping ….

Rats can deposit 35-45 droppings over a 24 hour period. During a 24 hour period, a mouse can deposit between 50-75 droppings.

URINE

Rodents use urine to communicate especially mice.

Rub Marks
Trails

Norway rat burrow

Rodent Gnawing

- Rodent gnawing is a natural and necessary survival behavior of rats and mice.
- It enables them to gain access to food and nesting materials.
- About 2% of daily activity is spent gnawing.
- Rat teeth grow at a rate of 0.4 mm per day.
- Tooth hardness index is greater than iron.
- Up to 7,000 PSI biting pressure.

*In fact the word rodent comes from the Latin word 'rodere' meaning to gnaw.*
Gnawing on Wires

Gnawing

Look for Evidence

Rats come out at night, so look around outside after dark. This will help you see where rats are going, so you can check for burrows when it gets light.
SEWERS

DEAD RATS DO TELL TALES

- Live or Dead Rats are a “dead” giveaway that you may have a pest problem.

DON’T FEED THE RATS

- Manage Your Garbage
- Keep Food Away
Can you spot the rodent food source?

COME & GET IT

Rodent Proofing
Before & After

How do rodents enter buildings?
- Dime to quarter sized hole
- Crack 1/4 - 1/2 inch or more

Rodent Proof
INSIDE

SANITATION IS PEST CONTROL

RODENT PROOF DOORS

Compactor rooms, meter rooms, slop sinks.

Highways
**Line of Sight Sanitation**

- Seal Gaps and Small Holes
- Fill Large Gaps and Holes
- Screen floor vents

**Build Them Out**

- Pest-Proofing with Copper Gauze
  - Use copper gauze to block up holes.
  - Mice cannot chew through it and it does not rust like steel wool. But steel wool is still better than nothing!
  - Wrap around pipes, especially where they pass through walls. Stuff into holes and cover with sealant or patch cement.
Foam Alone Does Not Exclude Rodents

In addition foam does not seal and moisture can collect giving rise to fungus and pests that feed on fungus.

Xcluder

Xcluder is made from stainless steel wool, it will last for years. YOU MUST WEAR GLOVES WHEN USING.

SEALEZE PEST STRIP
Block light and smells that draw pests
Deter pest entry
Conforms to irregular surfaces

Escutcheon Plates

Be sure sewer caps are on properly.
ULTRASONIC UNITS

- While some research shows these units may be of limited value other research indicates they are not.
- But the conclusion of experts is that they are not an effective control device.

Proper Trap Placement

RAT MYTH BUSTER

There is no “smell of death” associated with a trap that has already killed.
RODENTICIDE FORMULATIONS

Meal or Pellet:

Blocks:

Liquid:

Tracking Powder:

What's In A Bait Station?

Checking Bait Stations
RAT CONTROL

Largest and most diverse animal phylum. Arthropods are characterized by a segmented body covered by a jointed external skeleton (exoskeleton), with paired jointed appendages on each segment. Arthropods are mainly terrestrial, but aquatic representatives are well known.

ARTHROPODS

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INSECT DEVELOPMENT
METAMORPHOSIS = CHANGE

**Gradual:** Egg Nymph Adult

**Complete:** Egg Larvae Pupae Adult

YOU ARE WHAT YOUR MOUTH PARTS CAN EAT

Flies can have piercing or sponging

The common roach species of New York
American cockroach, Periplaneta americana, is about 1 ½ - 2”
Oriental cockroach, Blatta orientalis, 1 - 1 ½”.
German cockroach, Blattella germanica, about ½”.
Brown Banded, Supella longipalpa which is about ½”.

American

Oriental

German

Brown Banded
Roaches Have a “Gradual" Life Cycle

Why Roaches are considered pests.

• They contaminate food and eating utensils.
• They can destroy fabric and paper products.
• They can transmit disease-causing bacteria, including bacteria that causes food poisoning.
• They are responsible for allergy and asthma problems.
• They are capable of negative technological interaction.

Health Concerns

According to The Centers for Disease Control and Prevention (CDC), cockroaches are known to carry over 50 pathogens including pneumonia, assorted food poisoning pathogens and typhoid.
German Roach

**About 1/2-inch in length.**

**Description:** Brown with two dark, longitudinal stripes on the "shield."

**Behavior:** The German cockroach is the most prolific breeder among our roaches. Each egg capsule can contain up to 38 eggs and development from egg to adult can occur in as little as 45 days. Like all roaches, it is omnivorous and will eat anything people will and many things we won’t.

**Habitat:** In apartments, this pest will first locate itself in bathrooms and the kitchen, as close as possible to food and moisture sources. It spends about 80 percent of its time resting in cracks and voids.

**Control:** Sanitation, exclusion, trapping and application of insecticide baits, aerosols, sprays, dusts and Insect Growth Regulators (IGR).

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German Roach Characteristics

- Favor warm, moist places.
- Thigmotactic: they enjoy squeezing into tight places.
- Omnivorous: they eat just about anything.
- Cannibalistic: they eat each other.
- Coprophagous: they eat each other’s feces.
- Negatively phototropic: they avoid light.
- Nocturnal: they are active at night.
- German cockroaches carry their egg case (ootheca) around with them until about a day before the eggs hatch.

Because cockroaches are cannibalistic and coprophagous, insecticides can be passed from roach to roach.

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American Roach

They are the largest of the NY roaches.

Both nymphs and adults are shiny, reddish brown with a pate brown or yellow band around the edge of the head and back.

The wings of both the male and female extend slightly beyond the body.
American Roach

The American roach is the largest roach that infests homes and buildings in the United States. In Florida, the American roach is called the "palmetto bug," locally it is referred to as a "water bug". Like all roaches, it is omnivorous.

Habitat
This roach thrives in warm, damp environments, such as sewers, steam tunnels, basements, vent pipes, crawl spaces, boiler rooms and warm moist areas.

Control
Address moisture and sanitation issues associated with this pest seal or screen drains, sump pumps and open traps. Insecticide baits, spray, dusts, IGR and traps.

Oriental Roach

This female carries the egg capsule for about 30 hours and then drops it. They are generally found in sewer drains, crawl spaces, basements, cellars and the first floor of buildings.

Habitat
Oriental roaches prefer damp, cool, dark areas as opposed to warm areas.

Control
Conventional sprays and baits. Exclusion.

Brown Banded

The female carries egg capsule for a day or two before attaching it to a protected surface. They are generally found on ceilings, high on walls, closets and furniture. Commonly away from kitchens and bathroom.

Habitat
Brown-banded cockroaches prefer a dry, warm environment. In some places they are known as "TV roaches" because of their presence in living-room furniture and appliances.

Control
Dry baits and dusts work best.
ROACH IPM

SANITATION IS PEST CONTROL

Inspection

- Sources of water
- Sources of food
- Places to hide
- Points of entry
- Evidence of pests

Monitoring for pests

- Monitor traps are a basic tool of all IPM control programs.
- It allows pest control or in-house personnel to be alerted to new pest populations or identify hot spots.
- Learn how to read a monitor.
- Establish thresholds.
- Document control measures.
Roach Biological Control

BIO CHEMICAL CONTROL
Insect Growth Regulators

Mechanical Control

- All insects need food, water and shelter.
- Repair water leaks and sweating pipes.
- Remove clutter that provides hiding places.
- Use caulk to repair holes and cracks in walls especially around pipes.
- Sensitive areas or large infestations may utilize vacuum cleaners.
- **Sanitation is still the best method of cockroach pest management.**

Chemical Control

- Baits
- Crack & Crevice Aerosol
- Dusts
- Space Spray
- Liquid Applications
- Contact v Residual
FLIES

FLY LIFE CYCLE

MAGGOT
• FLY LARVAE ARE CALLED MAGGOTS
The Pupa

Unfortunately to the untrained or uninformed eye, fly pupa have been mistaken for rat droppings.

Fly Pupa           Norway Rat Feces

What FLIES Eat

Blood-feeding Flies  Filth-feeding Flies

BLOOD FEEDING FLIES

Horse flies are large, heavy-bodied flies that may reach up to 1 inch.

Deer flies yellow flies, green heads, ¾ to ¾ inch long. They often have distinct markings and brightly colored or iridescent eyes.

Their bites are painful, and at least one genus serve as mechanical vectors of tularemia.

They are often associated with moist situations such as marshes, swamps, and shorelines of lakes and ponds.

Stable flies. The stable fly, is similar to the house fly in size and coloration, but the mouthparts of both sexes are adapted for piercing the skin and taking blood.

Biting midges. These insects are tiny, but very aggravating biters sometimes called "no-see-ums," "punkies," or "salt marsh sand flies."

Black flies. When black flies bite with their blade-like mouthparts, people react rather violently, Black flies are small and present in large numbers.
FILTH FEEDING FLIES

Flies have long been known as transmitters of filth and disease.

Flies alight upon and frequently feed on almost any kind of filth.

Because of their sponging mouthparts, these flies can take only liquid food and typically dissolve solids either in saliva or regurgitated stomach contents.

House Fly

The house fly, is frequently the cause of complaints in all types of institutional, residential and commercial areas.

House fly maggots hatch and pass through three developmental stages during a three- to five-day period before migrating from the moist area and changing into an oval-shaped, reddish-brown *pupa*.

The adult fly develops and emerges after about a week or less.

In summer the life cycle may be completed in seven to 10 days, and the adult may survive for several weeks.

Blow Flies

It is usually this fly that is the culprit when numerous flies appear on or around windows. The sudden appearance of many adults inside often indicates an unemptied food trash can or the presence of a dead rodent or other animal.

NOTE: Blow flies are often used in forensic investigations, to determine time of death.
Fruit Fly

Fruit flies are small about 1/8-inch in length including the wings.
A key identifying character is its bright red eyes.
- Fruit flies are generally found hovering around decaying vegetation and overripe fruit.
- Fermenting materials, such as leftover beer or soft drinks, also are a favorite food of fruit flies.
- Life cycle from egg to adult is approximately 7 - 10 days.

Phorid Fly

They are usually tan to dark brown in color. The Phorid fly resembles the fruit fly but lacks the red eye color that is the trademark of the fruit fly.
A key identifying trait is that the Phorid fly has a distinctive habit of running rapidly across surfaces instead of immediately flying when disturbed.
The phorid fly breeds primarily in and feeds on moist decaying organic matter. The phorid fly can be found breeding wherever moisture exists, such as around plumbing and drains in bathrooms and kitchen areas, garbage containers, crawl spaces and basements. Because it frequents unsanitary areas this fly is of particular concern to hospitals, health care facilities and restaurants.

Drain Flies

- Moth flies (Drain flies) These small, dark flies are about 1/8 inch long with wings covered by tiny hairs. Larvae live in the gelatinous material in sink drain traps and sewers.
- The moth fly is a poor flyer and may be commonly seen walking or running on walls and other resting surfaces.
Fungus Gnats

- Fungus gnats are slender, delicate, dark-winged, mosquito-like insects. Their larvae infest moist soil and feed on fungi associated with decaying vegetation. Indoors, fungus gnats infest the highly organic soil of potted plants.

INSPECTION TIPS for SMALL FLIES

- Moist organic matter
- Decaying plant/vegetable/fruit matter
- Dumpsters, compactors, trash cans
- Where equipment legs meet the floor
- Discarded fruit cans or soda cans and recycle bins
- Under refrigerators in condensation pan
- Mop buckets, mops and mop closets
- Grease or food trapped in cracks of equipment
- Wet insulation in walls and ceilings
- Wet soil in potted plants (fungus gnat)

FLY CONTROL

- Proper Identification
- Elimination of breeding environment (SANITATION)
- Exclusion: Screen, Air Door, etc.
- Mechanical: Fly sticks, Fly Units, Fly Traps
- Chemical: Baits, Sprays, Growth Regulators
EXTERIOR LIGHTING

• Mount outdoor fluorescent lights at least 100 feet from the building to draw flies and other flying insects away from the entrance doors.
• Use sodium vapor lights at entrances and exits.
• Mercury vapor lights are 112x more attractive than sodium vapor lights.
• Use yellow “Bug Lights” bulbs in the summer.

OUTSIDE

Empty trash cans regularly, and schedule periodic pickup, so collected refuse does not sit around the building.

Exterior sanitation will impact both fly and rodent issues.

In closing, it is important to remember that while some insects may be considered pests, without insects life would be impossible.