Filth Flies, Cockroaches, Rodents, Oh My!

Pests of the Food Service Industry and What We Can Do About them

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Senior Scientist, Ecolab Pest Elimination

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Presentation Objectives

- Review of Important Pests
  - Filth (Large Flies)
  - Cockroaches
  - Rodents

- Integrated Pest Management (IPM)
  - Inspection and Monitoring
  - Exclusion and Structural Repairs
  - Sanitation
  - Physical Control Measures
  - Use of Pesticides

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FILTH (LARGE) FLIES

Pest Elimination Presentation Agenda

- Biology and Behavior: Why are they present?
- Food Safety Considerations
- Prevention and Action Steps

Biology and Behavior

Filth (Large) Flies

House Fly

Blow/Bottle Fly

Flesh Fly

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Biology and Behavior

Filth (Large) Flies

Blow/Bottle Flies (Calliphoridae)

- ¼- to ½-inch
- Metallic blue-green or copper colored
- Can be more abundant than house flies
- Lay eggs on garbage containing meat scraps, decaying organic matter, dead animals and feces
- Enter structures in fall to overwinter
- Life cycle 10 to 25 days

Flesh Flies

- ¼- to ½-inch
- Dark colored with three dark stripes on thorax
- Checkerboard pattern on abdomen
- Lay larvae on carrion or scraps of meat
- Life cycle 10 to 20 days

House Fly

- 3/16 to ¼ inch
- Dull gray with four dark strips on thorax
- Common insect
- Lay eggs on animal feces, garbage and decaying organic matter
- Life cycle 8 to 12 days

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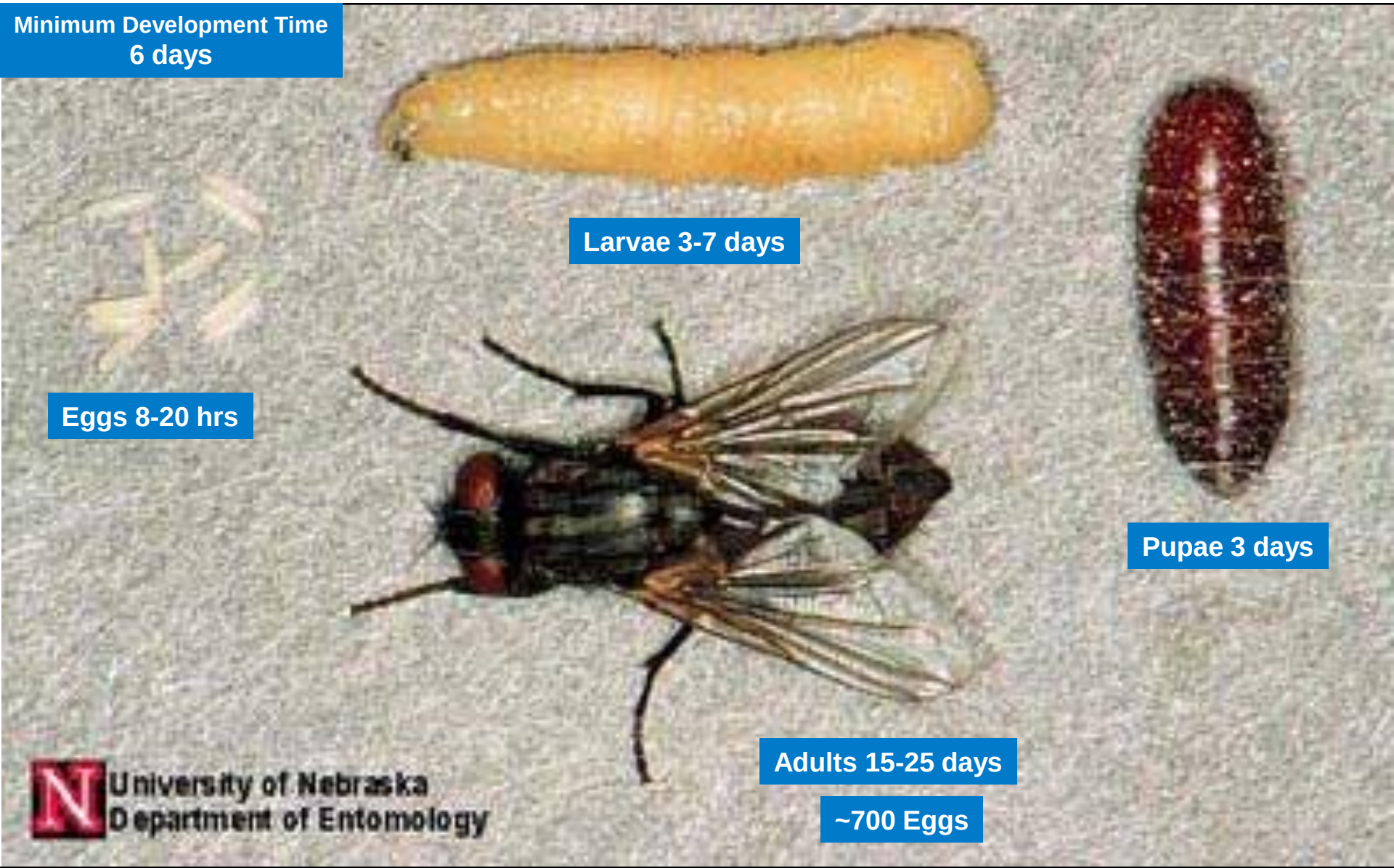
Biology and Behavior

Fly Development



Biology and Behavior

Seasonal Pressure

- Filth flies are generally seasonal pests
  - April – November in warmer climates
  - June – July in colder climates
- Temperatures >70° F stimulate fly emergence
- Temperatures <60° F significantly reduce fly activity

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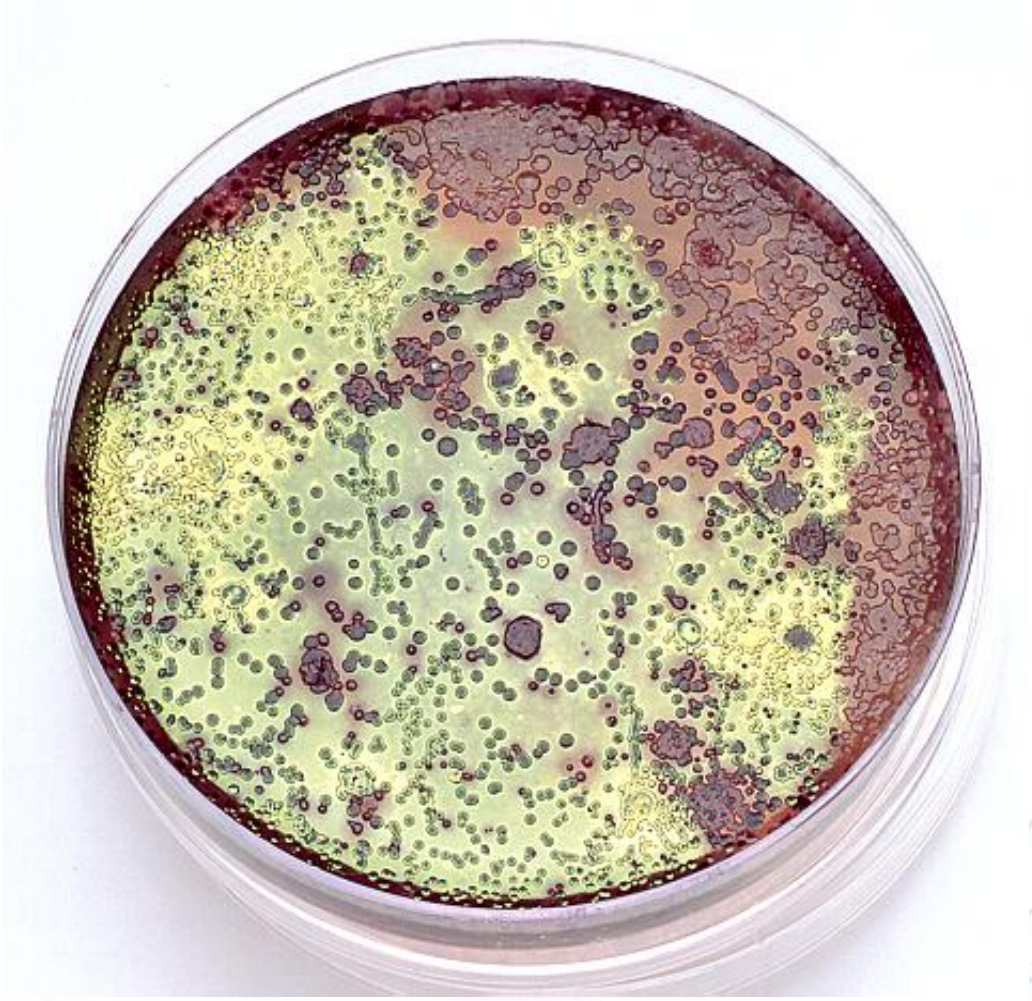
Food Safety Considerations

Filth Flies

- Generally breed outdoors
  - Trash receptacles, feces
  - Attracted to buildings by air current and odors
  - Attracted to UV light
- Enter through doors and windows
- Rest more than they fly
- Sponging mouthparts
  - Regurgitate liquid from stomach to dissolve food
  - Use sponging mouthparts to suck dissolved food up
  - Leave fecal or vomit spots where they walk or feed
- Disease vectors



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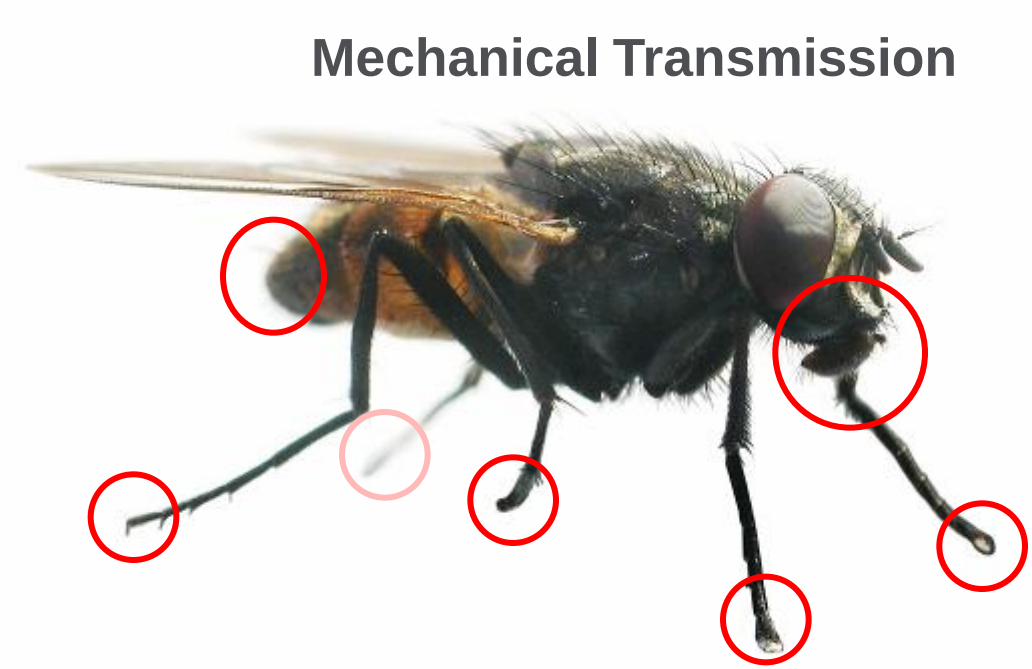
Food Safety Considerations

Filth Flies



- Food-Borne Pathogens
  - •***Escherichia coli***
  - •***Salmonella spp.***
- Other Pathogens
  - •**Amoebic Dysentery**
  - •**Anthrax**
  - •**Cholera**
  - •**Diphtheria**
  - •**Hepatitis**
  - •**Ophthalmia**
  - •***Shigella***
  - •***Streptococcus***
  - •***Tuberculosis***
  - •**Typhoid Fever**

The major danger these flies pose is transmission of pathogens through their activities. They contaminate food with their filth, and when combined with lapses in time and temperature, this can contribute to the spread of disease.

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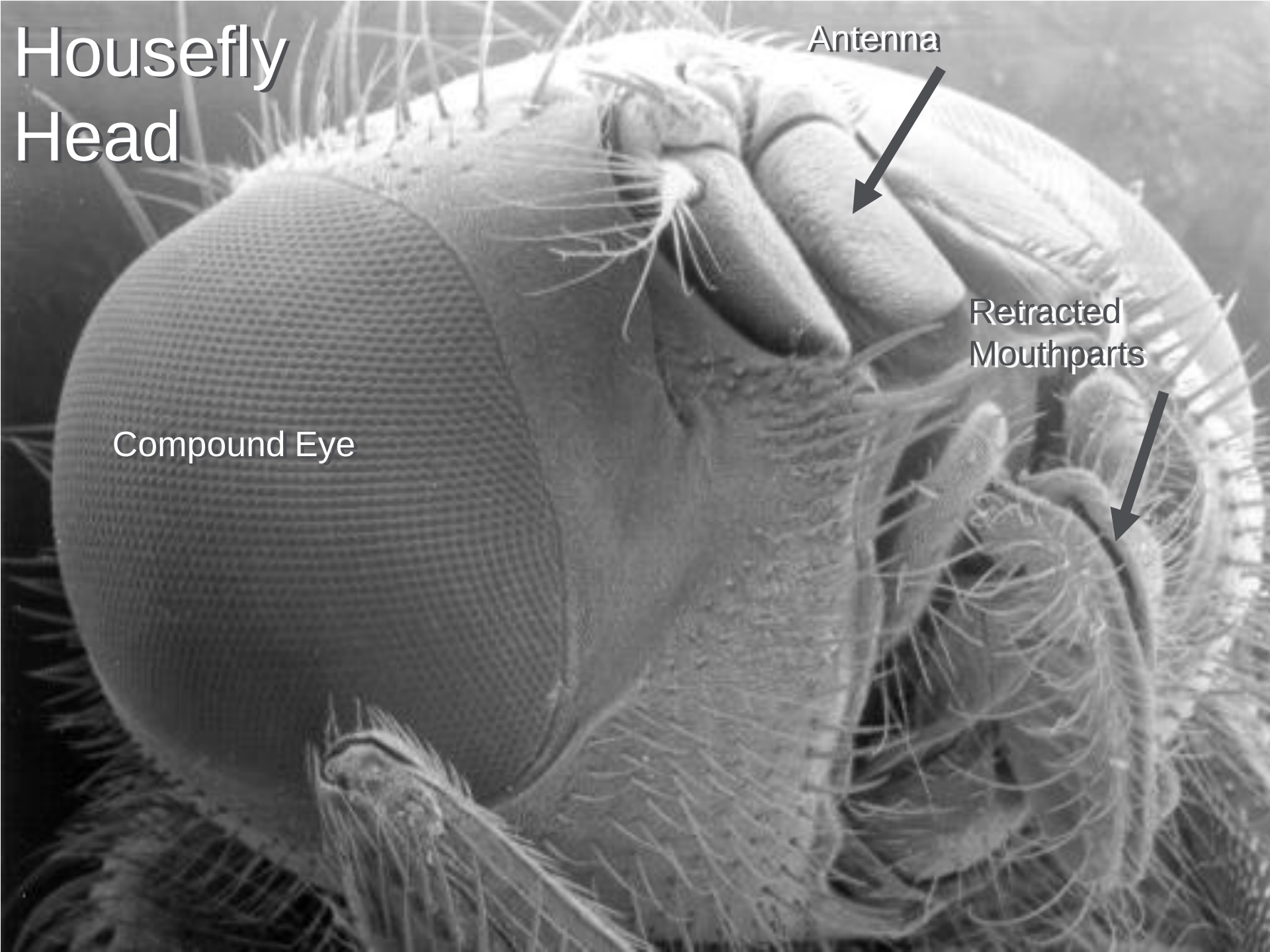
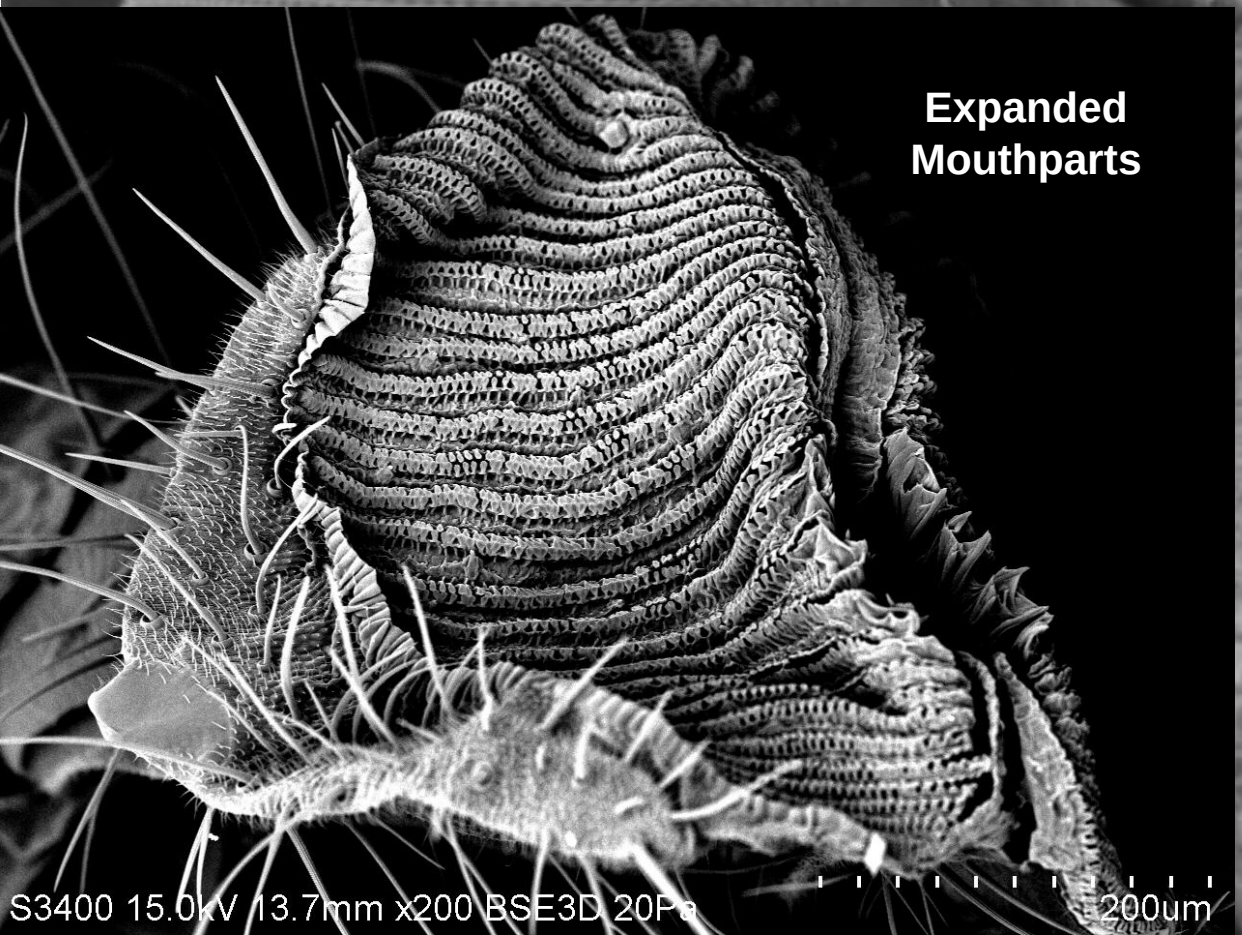
Dirty
Mouth?
www.forestryimages.org


Housefly Head
Antenna
Retracted Mouthparts
Compound Eye

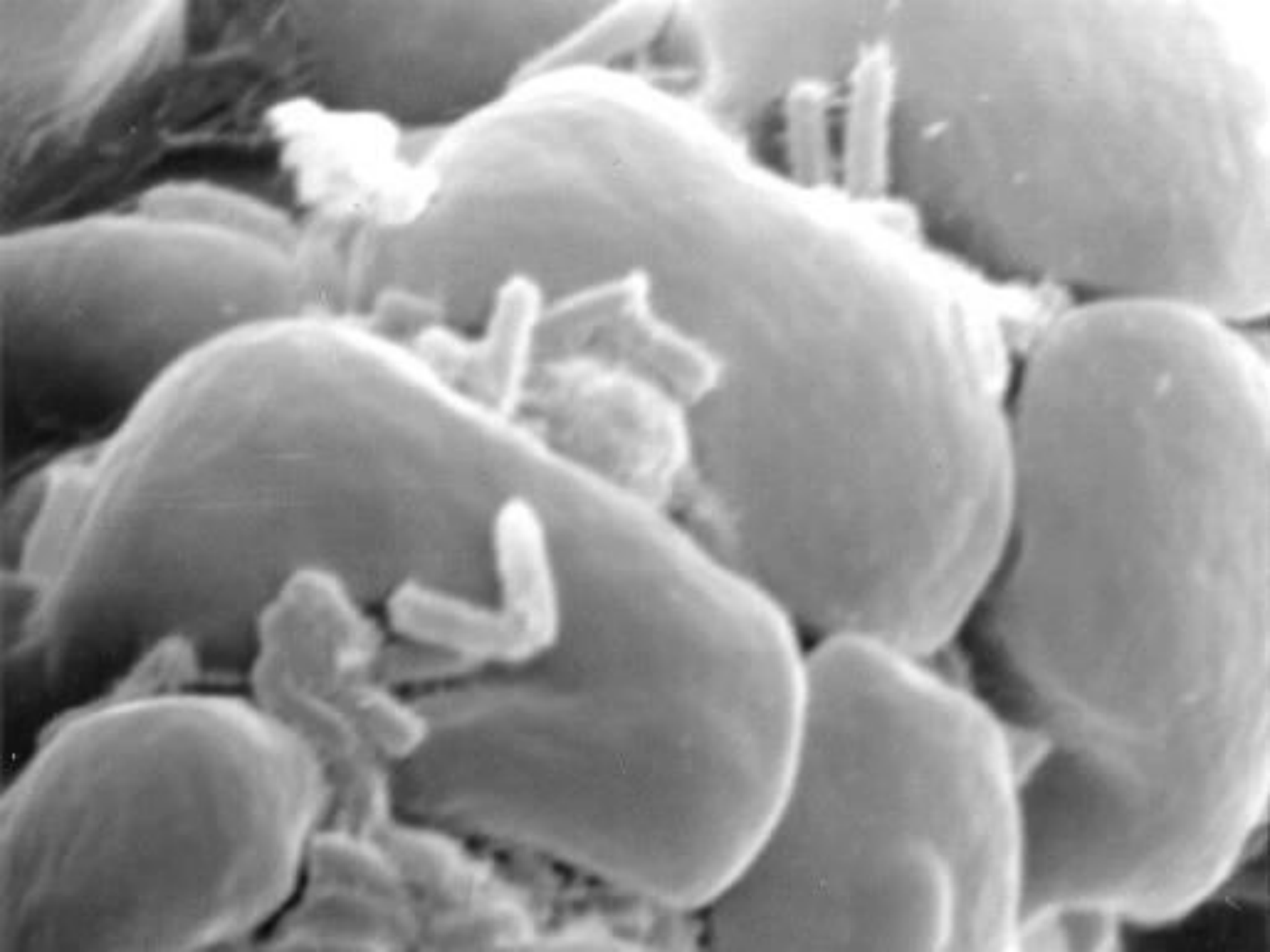
Housefly Head

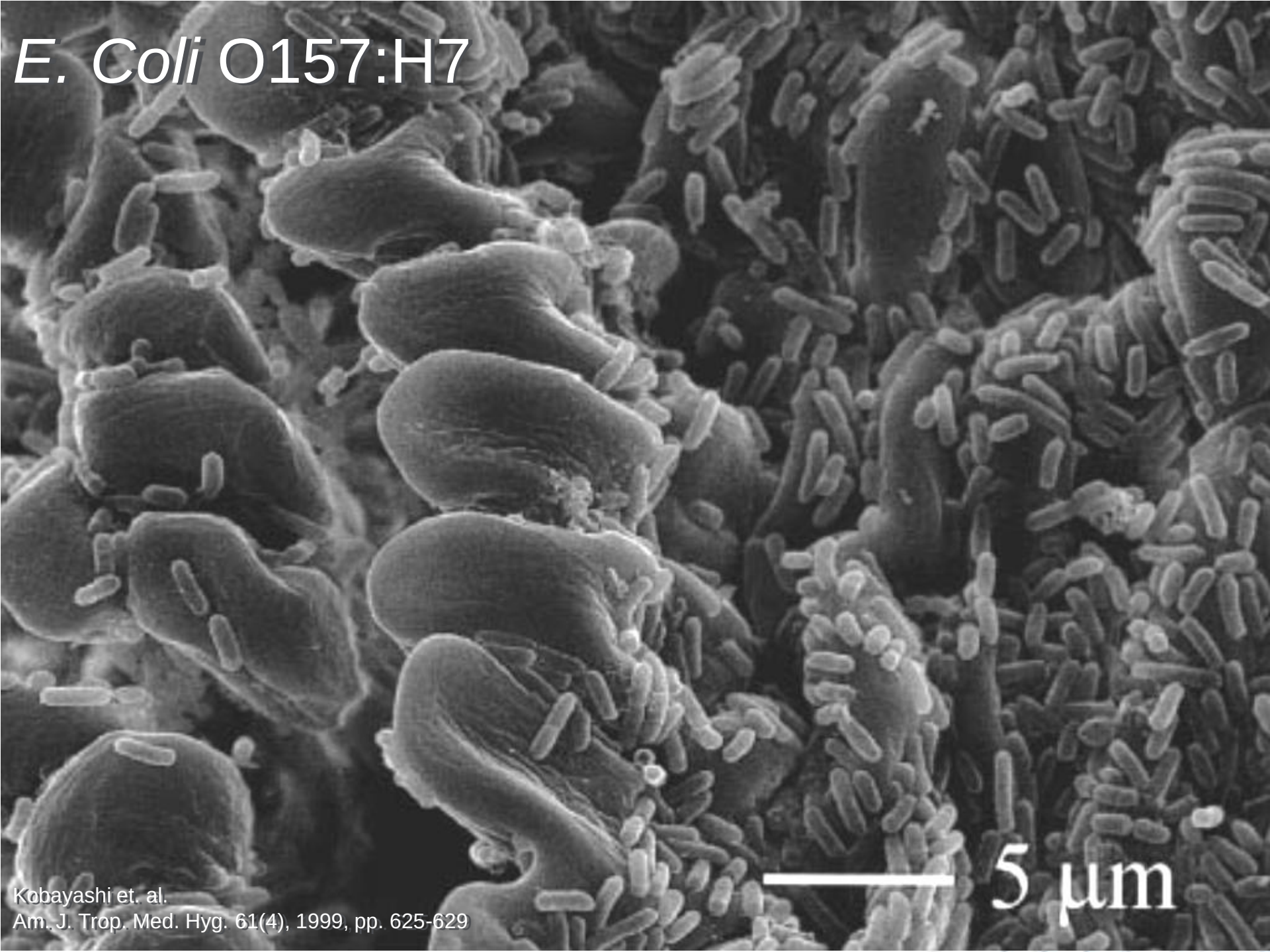
Antenna

Retracted Mouthparts

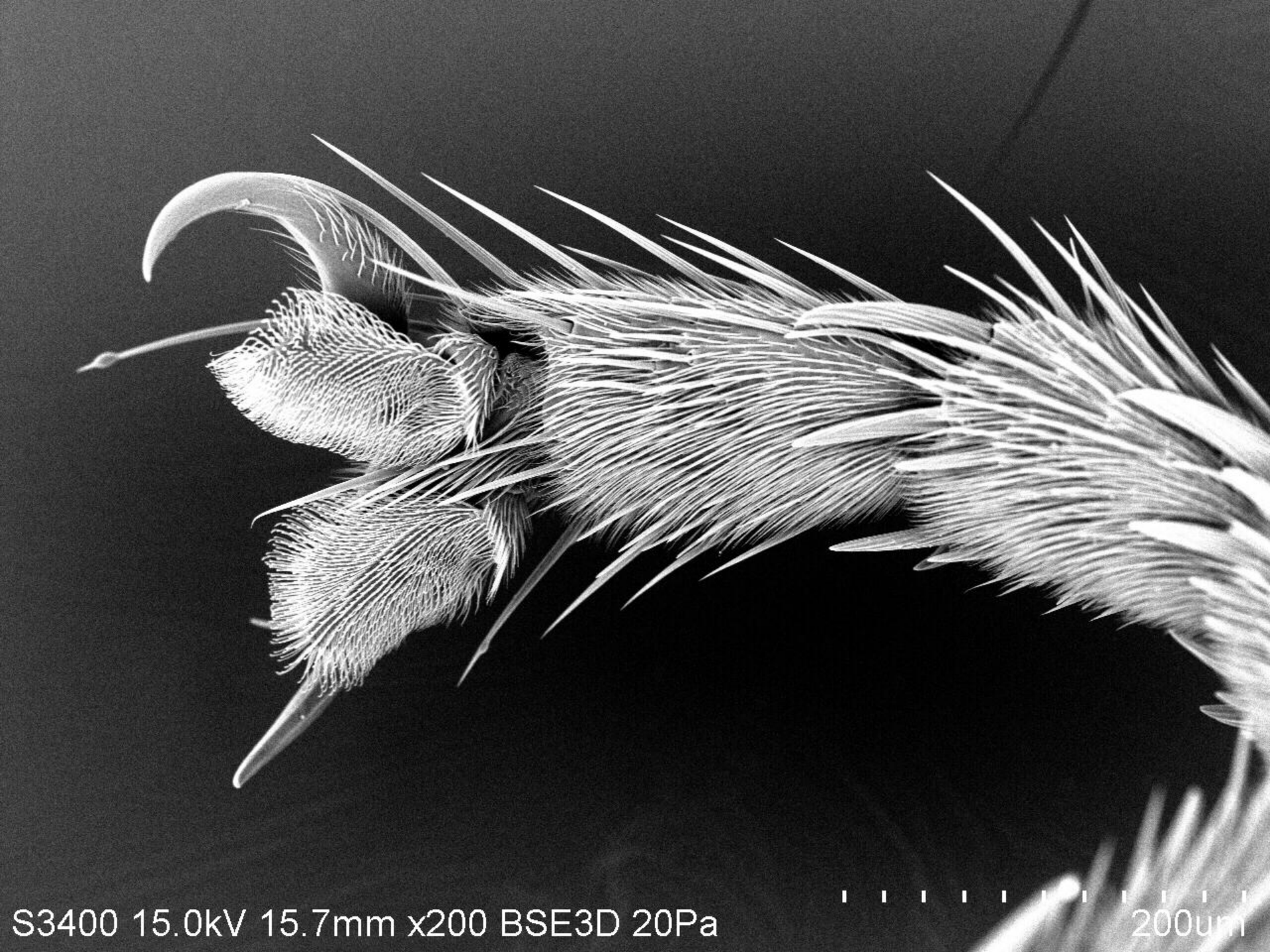


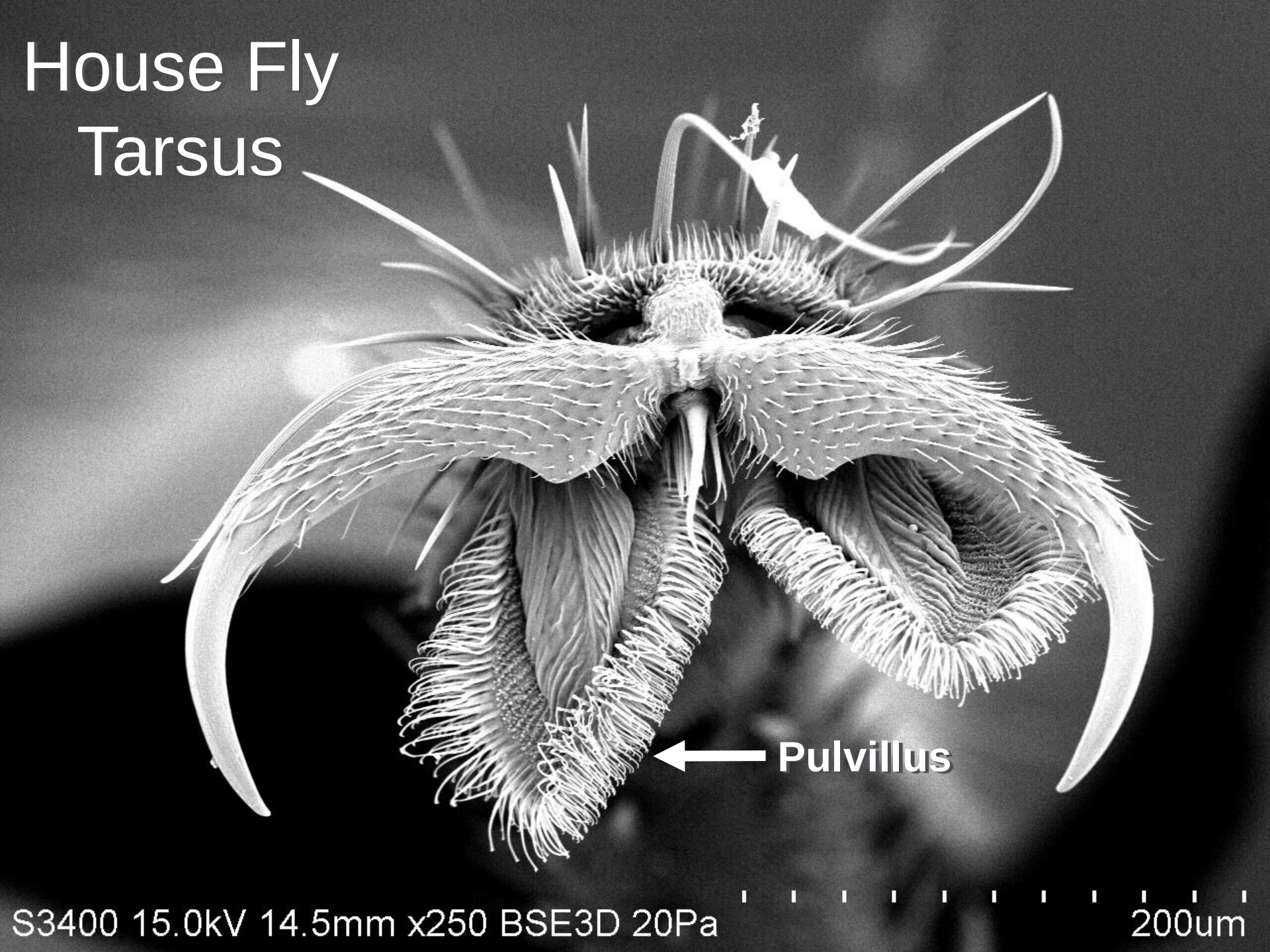

Housefly
Labella
Pseudotrachea

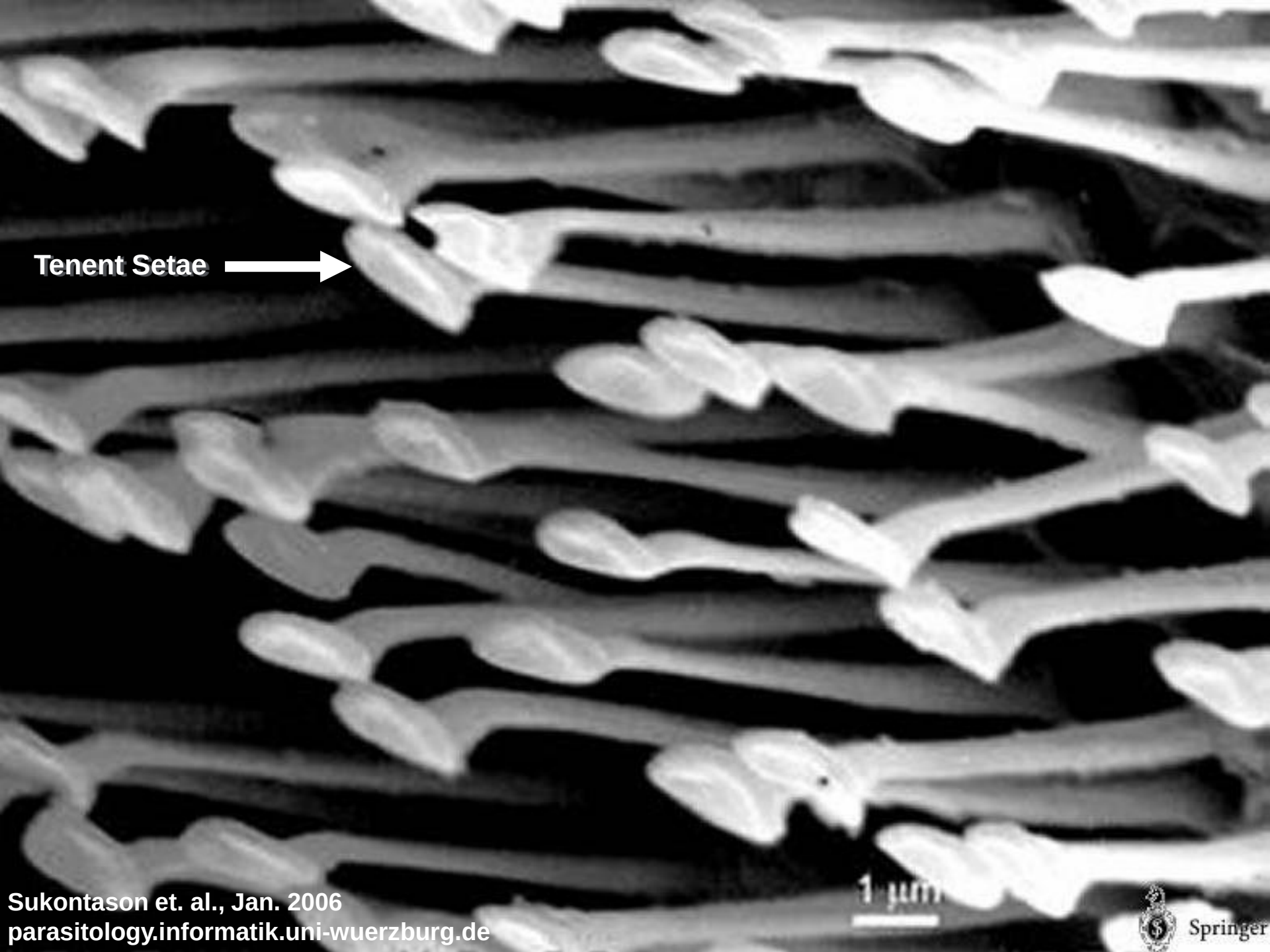



E. Coli O157:H7
5 µm
Kobayashi et. al.
Am. J. Trop. Med. Hyg. 61(4), 1999, pp. 625-629


Dirty
Feet?


S3400 15.0kV 15.7mm x200 BSE3D 20Pa
200um


House Fly
Tarsus
Pulvillus
S3400 15.0kV 14.5mm x250 BSE3D 20Pa
200um



Sukontason et. al., Jan. 2006
parasitology.informatik.uni-wuerzburg.de

Fly Speck

Marcel Denkhaus
commons.wikimedia.org

Fly Speck

Fly Speck

Spots of gut content deposited from the fly's mouth and anus

Spilled Garbage

Is there a problem here?

Prevention and Action Steps

Effective Pest Inspections

Outside-in Approach

- Reduce pest pressure outside
- Exclude pests
- Eliminate pests from inside
- Eliminate:
  - Sources of food
  - Water availability
  - Harborage sites

Prevention and Action Steps

Entry Points

- Exclusion Tools and Strategies
  - Keep doors and windows closed
  - Screens
  - Air pressure
  - Air doors
  - Strip doors

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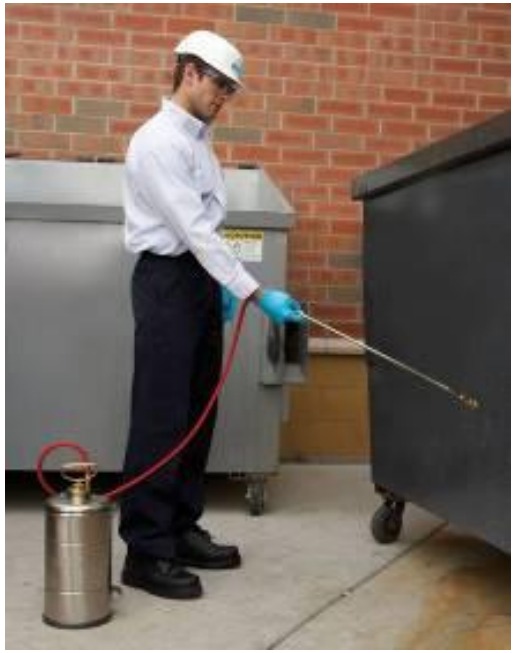
ILTs
Bulb Replacement

Prevention and Action Steps

Exterior Treatment

Stop flies where they start – at outside breeding sites

- Targeted insecticide applications
  - Dumpster area
  - Around doors
  - Other breeding sites
- Stealth Fly Station Installation and Monthly Service



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COCKROACHES

Common Cockroaches

Domestic Species

Male Female

German

Male Female

Brown-Banded

Peridomestic Species

American

Australian

Brown

Smoky Brown

Oriental

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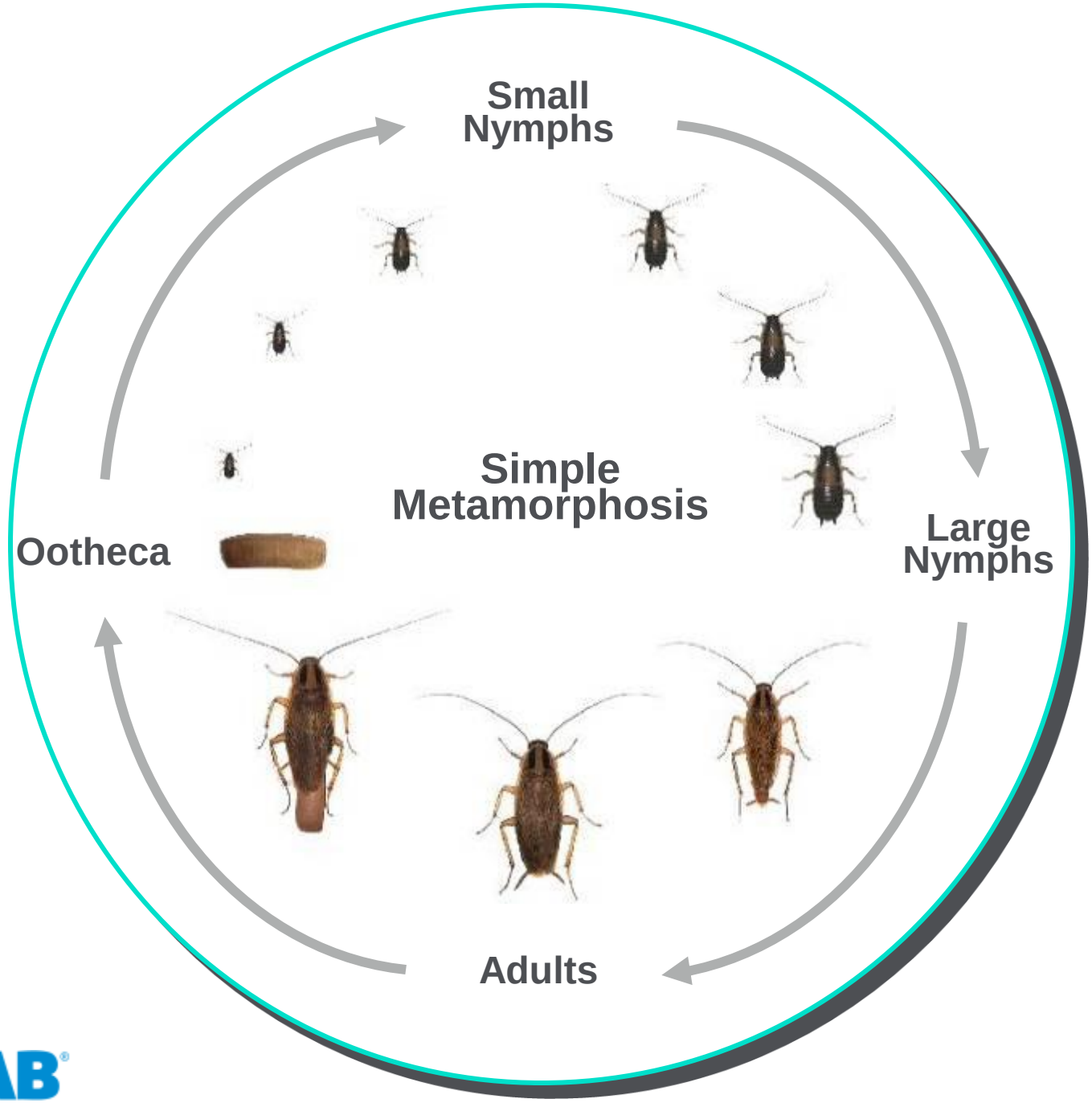

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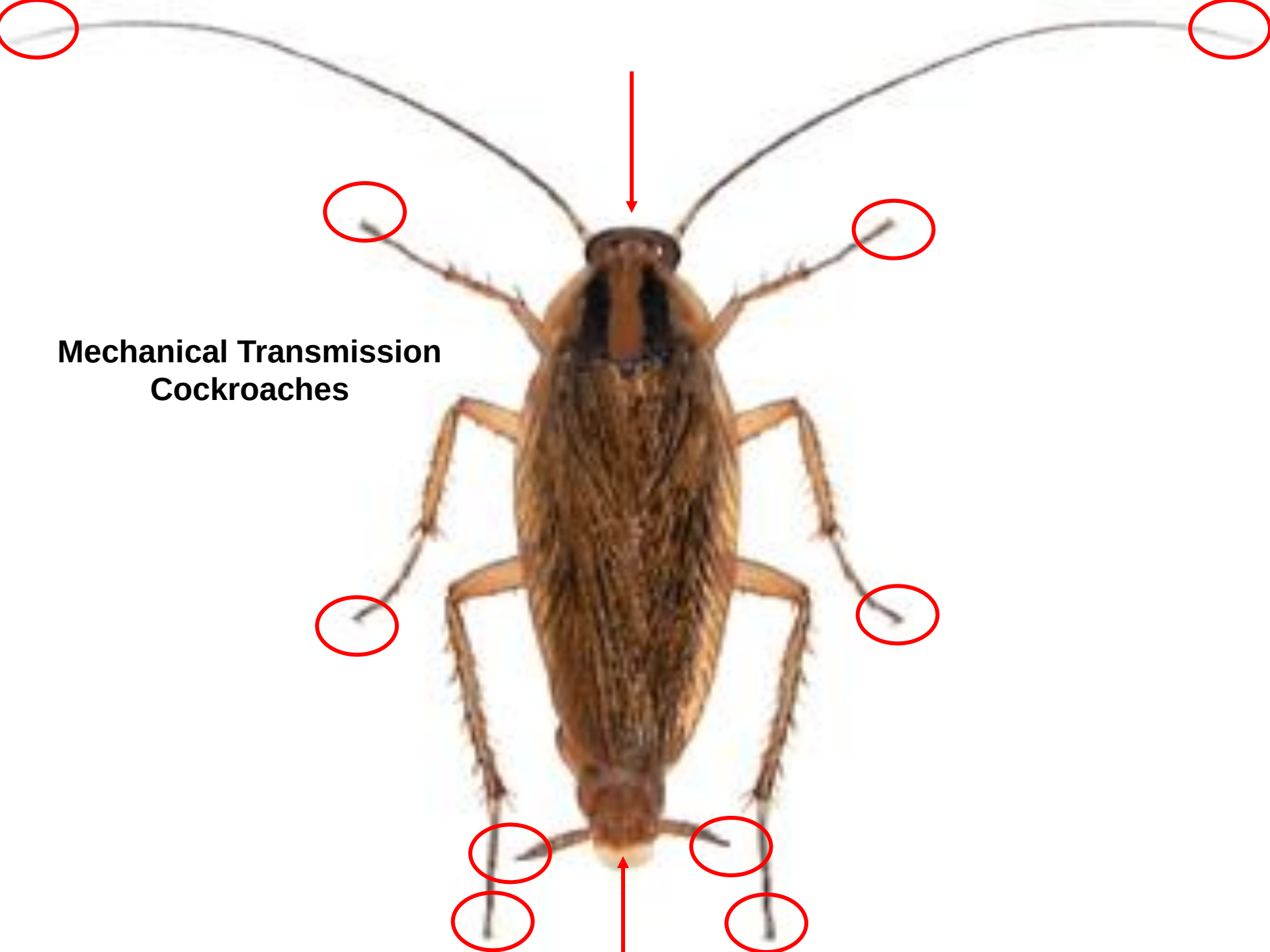
Mechanical Transmission
Cockroaches



Mechanical Transmission

- Food-Borne Pathogens
  - *Escherichia coli*
  - *Salmonella spp.*
  - *Bacillus subtilis*
  - *Clostridium perfrigens*
  - *Serratia marcescens*
  - *Pseudomonas aeruginosa*
- Other Pathogens
  - *Alcaligenes faecalis*
  - *Campylobacter jejuni*
  - *Clostridium spp.*
  - *Enterobacter aerogenes*
  - *Klebsiella pneumoniae*
  - *Mycobcterium lebrae*
  - *Shigella dysenteriae*
  - *Staphylococcus spp.*

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Signs of Cockroach Activity

- Live Activity
- Fecal Matter
- Cracks and crevices (walls, machinery, crates, pallets)

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Root Causes of Cockroach Activity

- Incoming shipments
- Re-used crates and pallets
- Corrugated materials
- Staff/Visitor

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Prevention and Control

- Eliminate harborage areas, food, and water by
  - Correcting Structural Deficiencies
  - Improved Sanitation
  - Communication
  - Employee Awareness
  - IPM

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RODENTS

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Common Rodents

Food-Borne Pathogens

- ***Escherichia coli***
- ***Salmonella spp.***

Other Pathogens

- **Amoebic Dysentery**
- **Anthrax**
- **Cholera**
- **Diphtheria**
- **Hepatitis**
- **Lyme Disease**
- **Hantavirus**
- **Ophthalmia**
- ***Shigella***
- ***Streptococcus***
- ***Tuberculosis***
- **Typhoid Fever**

House Mouse
Mus musculus

Deer Mouse
Peromyscus maniculatua

Norway Rat
Rattus norvegicus

Roof Rat
Rattus rattus

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Biology

- **Vision**
  - Poor Vision
  - Color Blind
- **Hearing**
  - Good
- **Taste**
  - Highly Developed
- **Smell**
  - Very Important
- **Touch**
  - Rely heavily on the sense of touch

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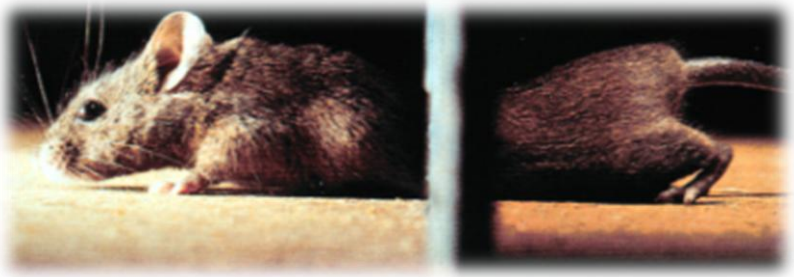
Habits and Behaviors

- **Entry/Exploration**
  - Mice ¼” entry
  - Rats ½ “ entry
  - Mice are inquisitive
  - Rats are neophobic (wary)



What You Can Do

Components of a successful pest program:

- Science-based service approach
- Partnership between you and your pest service provider

Exterior Rodent Management

- Inspection
  - Signs of Rodent Activity
  - Identify Rodent Species If Present
  - Identify Conducive Conditions
  - Identify Entry Points
- Service Approach
  - Review Logbook
  - Install Exterior Equipment
  - Inspect and Service Monthly

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Inspection for Signs of Rodent Activity

Droppings

Rub Marks

Swing Marks

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Identify Conducive Conditions

- Water Sources
- Food Sources
- Sanitation Issues
- Structural Issues
- Landscaping Issues
- Employee Practices

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Conducive Conditions – Water Sources

Conducive Conditions – Structural Issues

Conducive Conditions – Landscaping

Identify Entry Points - Exclusion

- Seal gaps ≥ ¼ - inch with industrial materials

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Identify Entry Points - Exclusion

- **Gaps and voids** — Repair pipe chases and access points to guard against pest entry and harborage
- **Kitchen walls** — Repairing small holes in kitchen walls can help eliminate potential nesting areas and points of entry
- **Delivery and entry points** — Commercial grade door sweeps will be installed day of service to help prevent pests from entering

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Ecolab Service - Exterior

- Place rodent stations around the exterior perimeter out of public view; generally around the rear service entry door and dumpster corral
- Document
- Inspect and service stations monthly

Interior Rodent Management

Interior Rodent Management

- Inspection
  - Signs of Rodent Activity
  - Identify Rodent Species If Present
  - Identify Conducive Conditions
  - Identify Entry Points
- Service Approach
  - Install Interior Rodent Equipment
  - Inspect and Maintain Equipment Monthly
- Communication
  - Document Activity, Conducive conditions
  - Document Service and Product Information

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Identify Conducive Conditions

- Water Sources
- Food Sources
- Sanitation Issues
- Structural Issues
- Employee Practices

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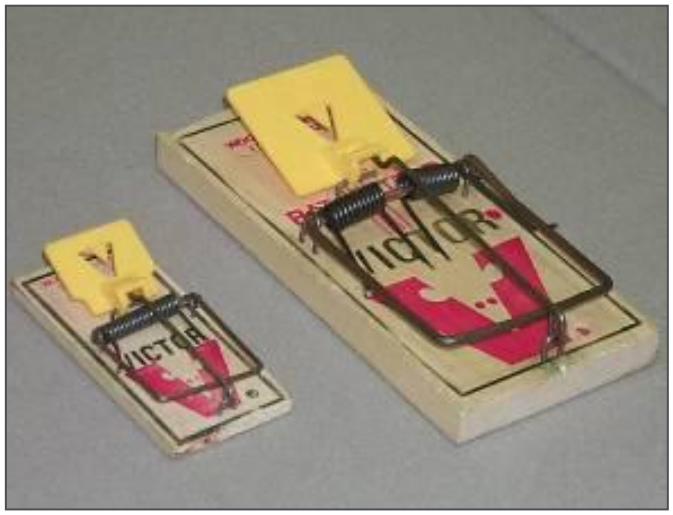
Conducive Conditions – Food Sources

Conducive Conditions – Water Sources

Conducive Conditions – Structural Issues

Ecolab Service - Interior

- Install Interior Rodent Equipment
- Snap Traps Used as Needed to Eliminate Existing Rodents
- All Traps Placed Discretely to Minimize Impact on Facility Operation
- No Traps on Floor Level Unless Restaurant is Closed for an Infestation Treatment.
- Document
- Inspect and Service Traps Monthly
- Document all Activity, Conducive Conditions, Service and Product Information



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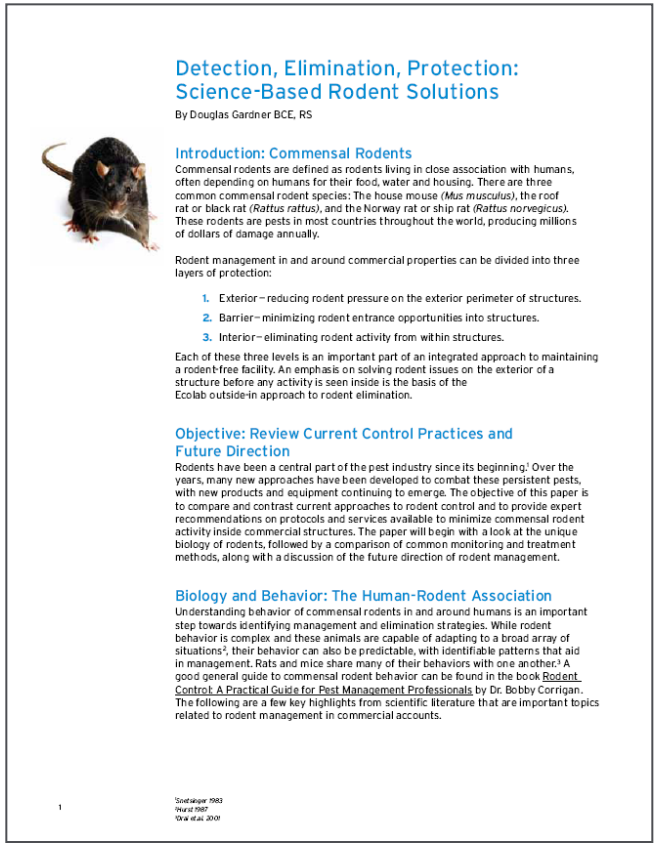
Helpful tools developed by Ecolab:

White paper



Detection, Elimination, Protection: Science-Based Rodent Solutions

By Douglas Gardner BCE, RS

Introduction: Commensal Rodents

Commensal rodents are defined as rodents living in close association with humans, often depending on humans for their food, water and housing. There are three common commensal rodent species: The house mouse *(Mus musculus)*, the roof rat or black rat *(Rattus rattus)*, and the Norway rat or ship rat *(Rattus norvegicus)*. These rodents are pests in most countries throughout the world, producing millions of dollars of damage annually.

Rodent management in and around commercial properties can be divided into three layers of protection:

1. Exterior – reducing rodent pressure on the exterior perimeter of structures.
2. Barrier – minimizing rodent entrance opportunities into structures.
3. Interior – eliminating rodent activity from within structures.

Each of these three levels is an important part of an integrated approach to maintaining a rodent-free facility. An emphasis on solving rodent issues on the exterior of a structure before any activity is seen inside is the basis of the Ecolab outside-in approach to rodent elimination.

Objective: Review Current Control Practices and Future Direction

Rodents have been a central part of the pest industry since its beginning.[1] Over the years, many new approaches have been developed to combat these persistent pests, with new products and equipment continuing to emerge. The objective of this paper is to compare and contrast current approaches to rodent control and to provide expert recommendations on protocols and services available to minimize commensal rodent activity inside commercial structures. The paper will begin with a look at the unique biology of rodents, followed by a comparison of common monitoring and treatment methods, along with a discussion of the future direction of rodent management.

Biology and Behavior: The Human-Rodent Association

Understanding behavior of commensal rodents in and around humans is an important step towards identifying management and elimination strategies. While rodent behavior is complex and these animals are capable of adapting to a broad array of situations[2], their behavior can also be predictable, with identifiable patterns that aid in management. Rats and mice share many of their behaviors with one another.[3] A good general guide to commensal rodent behavior can be found in the book Rodent Control: A Practical Guide for Pest Management Professionals by Dr. Bobby Corrigan. The following are a few key highlights from scientific literature that are important topics related to rodent management in commercial accounts.

1

[1] Snetsinger 1983
[2] Ward 1987
[3] Qiu et al. 2001

"Rodent Readiness" Instructional Video

2:15 Science and field research tell us a lot about rodents. The more you know, the more effective you can be in keeping them out of your facility. In the next three minutes, we'll tell you how you can help secure your facility against rodents.

Expanding the Large Fly Program

The Need and Approach to Innovation

The Need for Innovation

Turning Biology and Behavior into Business Solutions

- Flies a known vector of bacteria and Health Department concern; containing over 6 million bacteria on its body[1]
- Need for sustainable solutions
- These pests are common, but the severity of issues for some customers instigated search for new technologies

1. Krats (1997) Attacking the problem of indoor air containants. Pest Control Technology Dec 1997, p. 62

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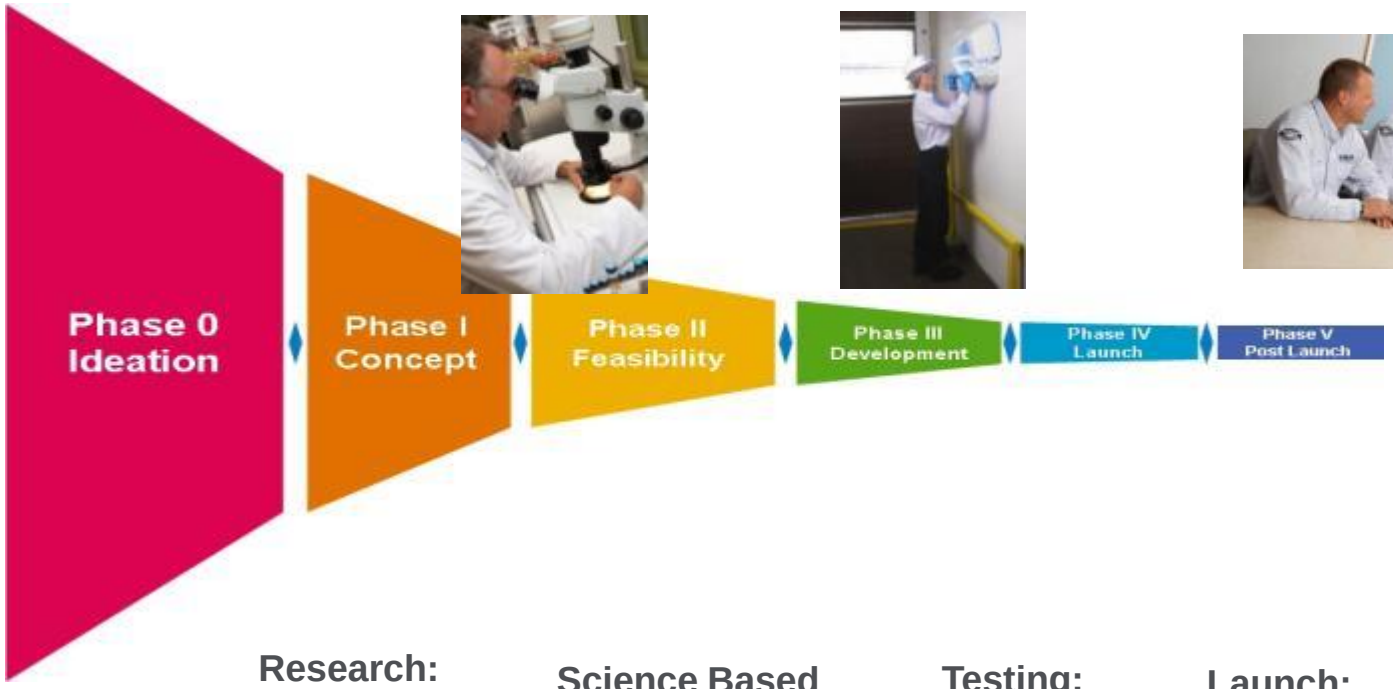
Ecolab Innovation Process



Customer Input

Research:
Literature
Industry
Patents
Pest Behavior

Science Based Solutions:
Formulations
Devices
Protocols

Testing:
Lab Tests
Field Tests
Pilots

Launch:
Service Tools
Customer Tools

Customer Input

Process designed to continually serve customer needs

Current Service Model

Lifespan of a Fly Regarding Customer Facilities

Egg Maggot Pupa Adult

Attempt to Breed

Hang Near Entrance

Enter Facility

Explore

Rest

Try to Leave

Die

Exterior Treatments

Opportunity:
Reduce Entry
Into Facility

Fly Lights

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Large Fly Laboratory Testing

Study of Exploratory Behavior Leads to New Technology

- R&D facility in Eagan, MN contains full insectary and breeds 2,000 house flies per week
- Scientists release and study exploratory behavior of flies, one by one, to understand common behaviors
- Introduce and test multiple stimuli to attract flies and predict behavior patterns, repeat testing to significant levels

Results: Flies attracted to multiple stimuli such as color and other visual elements, movement, heat, odor

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Developing Technology for Customers

Combining Scientific Research and Customer Needs

- Multiple options to attract and eliminate flies quickly, but not all cost effective or fit needed areas

- Introducing ***Stealth Fly Stations***
  - Combines multiple attractive qualities such as black color, reflective surface and fly attractant odor
  - Textured exterior to hold product longer through both rain and UV exposure
  - Exterior based solution
  - Monthly treatment with pesticide and attractant

- 2012 Kitchen Innovations Award Winner

Stealth Fly Station

KI KITCHEN INNOVATIONS 2012 AWARD NATIONAL RESTAURANT ASSOCIATION RESTAURANT, HOTEL-MOTEL SHOW

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Ecolab Rodent Program Innovation

Startle vs. Foraging Behavior

Startle Behavior

Escape response to potential threats or when suddenly found in an unfamiliar environment

- Unfamiliar territory - Dive into the close, potential safe areas – into holes or behind objects
- Best approaches – Close proximity hiding places (multi-catch traps near entrance points)

Foraging Behavior

Normal, daily behavior – finding food & water, social interactions, territory exploration

- Established foraging routes and patterns of activity
- Cautiously approach new items to investigate (curious)
- Best approaches - Snap traps, baiting and structural modification
- Ineffective approaches – multi-catch traps, glue boards

Equipment Gap – Foraging Behavior (Elimination of infestations)

Beyond the doorway – A single station to meet all interior needs

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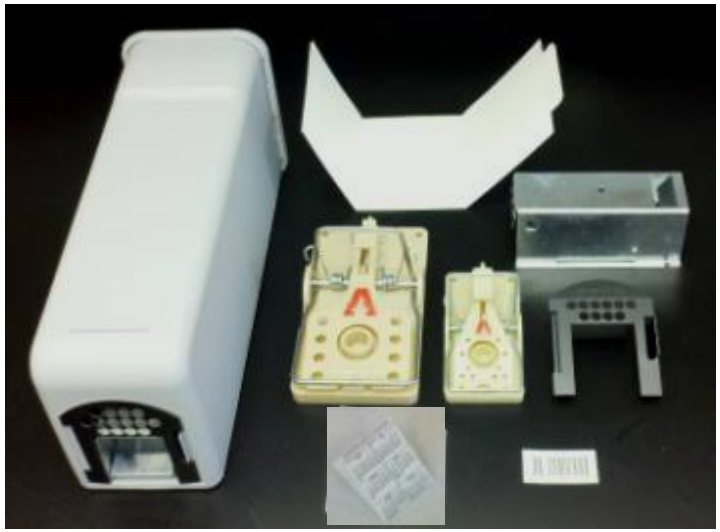
CheckPoint Interior Station



Single interior station that addresses both startle and foraging behaviors in mice and rats.

- **Cost Effective Solution**
  - Durable, Injection-mold base harborage
  - Removable end-cap and doors
  - Flexible design for multiple use options
- **Service Efficiency**
  - Multiple-catch entrance (teeter-totter)
    - Single direction entrance for doorway protection
    - Bi-directional configuration also available
  - Open access entrance
    - Mouse/rat snap traps
    - Glue board
    - Monitoring station (bait or other attractant)
  - Mouse or rat capable
- **Other Features**
  - Durable design with high impact plastic
  - Protected bar-code / date card
  - Ramped base for moisture removal
  - High contrast entrance
  - Anchor or tether able – anchor in development

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CheckPoint® Interior Rodent Station

Shadow Technology

Investigative Behavior: Vision is an important sense for rodents and dark shadows indicate possible hiding spots to investigate. This behavior is especially true for rodents in unfamiliar environments and is the main reason why multi-catch traps work as monitors near rodent entrance points.

High Contrast: Trap catches can be enhanced by providing a high-contrast dark area at the entrance. Trap openings are naturally dark but additional black, high contrast emphasis can be placed around the opening to increase rodent investigatory responses.

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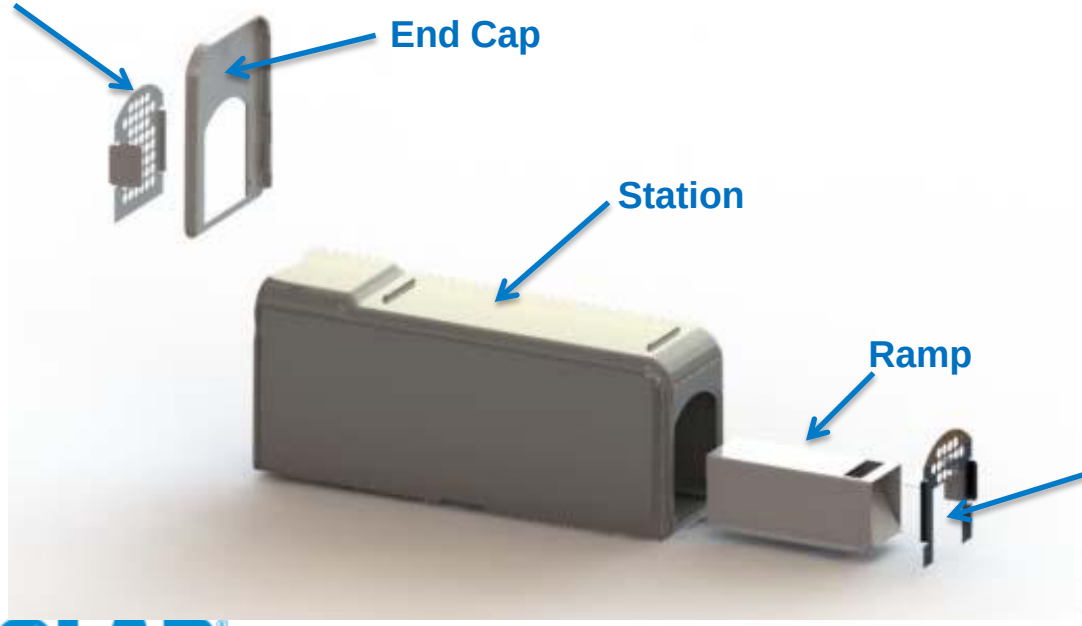
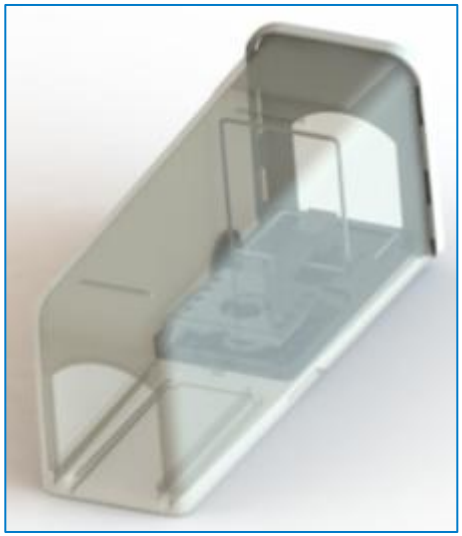
CheckPoint® Interior Rodent Station

Trapping Configurations for Mice and Rats

Mouse Trap Configuration



Rat Trap Configuration



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CheckPoint® Interior Rodent Station

When/Where should it be installed?

Rats/Discreet: When there is an established rat population and/or there is a need for discreet snap trap placement. The CheckPoint® Interior Rodent Station is effective for both mice and rats, and allows for snap traps to be used in new locations that previously had to be avoided due to public and customer view.

Shape: In interior locations where the long narrow shape of the CheckPoint® Interior Rodent Station is a better fit than other device options (e.g., the back of gondolas, shelving, in wall voids.

Tether/Durability: In situations where a CheckPoint® Interior Rodent Station needs to be tethered, ridges on top of the station and a groove on the bottom allow it to be secured in place with a simple strap or zip tie. The CheckPoint® Interior Rodent Station has a durable design and is made of crush-resistant plastic.

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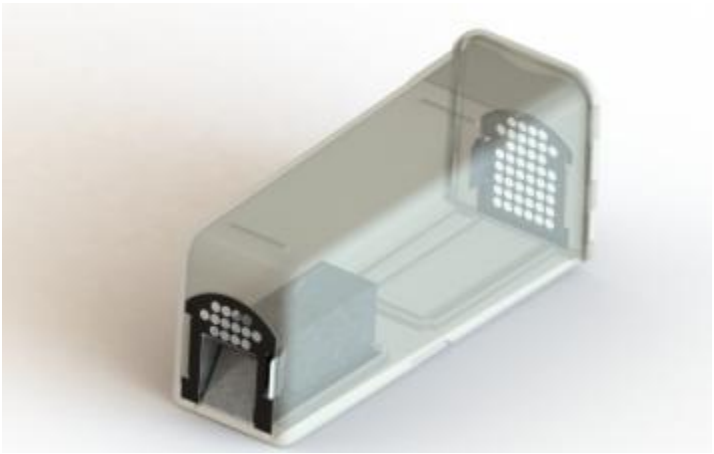
Rodent Program

Exterior

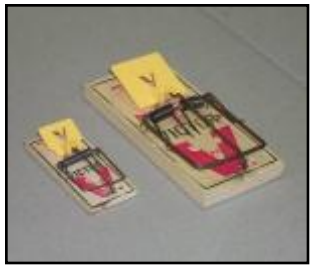
Barrier

Interior

Monitoring



Elimination



Startle vs. Foraging

Rodent Program

White Paper

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[1] [illegible]
[2] [illegible]
[3] [illegible]