Public Health and Fly Control

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Principle foodborne pathogen infections estimated for 1997

- Norwalk-like viruses: 9,200,000
- Campylobacter spp: 1,963,000
- Salmonella (non-typhoid): 1,942,000
- Clostridium perfringens: 185,000
- Giardia lamblia: 249,000
- Staphylococcus food poisoning: 200,000
- E. coli O157:H7 and other Shiga-toxin Ec: 134,000
- Shigella: 99,000
- Salmonella typhi (typhoid fever): 97,000
- Hepatitis A: 4,000
- Salmonella typhimurium: 4,000
- Staphylococcus food poisoning: 2,000
- Salmonella (typical typhoid fever): 659
- Trichinella: 52

From Tauxe 2002, Int. J. Food Microbiol. 70:31-41

Flies and Certain Disease Potentials

- Bacteria
  - Acinetobacter spp
  - Campylobacter spp
  - Chlamydia trachomatis
  - Enterobacter spp
  - Enterococcus spp
  - Escherichia coli O157:H7
  - Helicobacter pylori
  - Klebsiella spp
  - Proteus spp
  - Pseudomonas aeruginosa
  - Salmonella enteritidis
  - Shigella sonnei
  - Staphylococcus aureus
  - Streptococcus
  - Vibrio cholerae
  - Yersinia pseudotuberculosis

- Viruses
  - Coxsackievirus
  - Enteroviruses
  - Poliovirus

- Parasites
  - Cryptosporidium parvum
  - Entamoeba histolytica
  - Giardia lamblia
  - Entamoeba coli
  - Entamoeba hartmanni

Flies Commonly Found Around Homes

- House flies
- Latrine flies
- Little house flies
- Blow flies
- Cluster flies
- Flesh flies
- Stable flies
- Drain flies

House fly-transmitted pathogens known to affect human health

- Bacteria
  - Acinetobacter spp
  - Campylobacter spp
  - Chlamydia trachomatis
  - Enterobacter spp
  - Enterococcus spp
  - Escherichia coli O157:H7
  - Helicobacter pylori
  - Klebsiella spp
  - Proteus spp
  - Pseudomonas aeruginosa
  - Salmonella enteritidis
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- Viruses
  - Coxsackievirus
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- Parasites
  - Cryptosporidium parvum
  - Entamoeba histolytica
  - Giardia lamblia
  - Entamoeba coli
  - Entamoeba hartmanni
E. coli O157:H7
Salmonella spp
Listeria monocytogenes
Shigella
Staphylococcus aureus
Campylobacter jejuni
Salmonella typhi
Shigella spp
Staphylococcus spp
Yersinia enterocolitica
E. coli
Campylobacter
Listeria
Noroviruses

Factors involved in the emergence of produce-linked outbreaks

- Changes in consumer habits
  - Increased consumption of meals outside the home
  - Increased popularity of salad bars
  - Increased consumption of fresh fruits and vegetables

Number of E. coli O157:H7 outbreaks in fresh produce from 1982-2004

Adapted from Aruscavage et al. 2006

Cattle are major reservoirs of *E. coli* O157:H7
- Confined to the gastrointestinal tract of cattle
- Number of organisms shed in cattle feces vary between $10^4$ - $10^6$ CFU/g

- Acquiring Pathogens
  - Filth flies require bacteria for development
  - Females are attracted to manure, corpses, rotting vegetation – harbor bacteria
  - Maggots consume bacteria
  - Adults feed on bacteria laden substrates
  - Mouthparts, feet, body become contaminated

- Pathogen Inoculation (contamination)
  - Regurgitation
  - Defecation
  - Walking
  - Grooming

- Filth Fly Vector Competence
  - What is the fate of bacteria deposited on plants?
    - Regurgitation spots
  - How efficiently do house flies move bacteria to leafy greens?
    - Retention time on fly body surfaces

E. coli O157:H7 regurgitated onto the spinach surface and detected by SEM.
After 7 days, the quality of manually spotted *E. coli* O157:H7 declines on the spinach surface over time, suggesting that fly regurgitant supports bacterial growth.

Retention of *E. coli* O157:H7 on fly body surfaces

Bacteria also found on other parts of the labellum and head of house flies.

Detection of *E. coli* O157:H7 on external fly surfaces


Changing Face of Rural America
Sanitation

- Study revealed that 50% of trash bins in a metropolitan area were infested with fly maggots
- Keep lids closed tight
- Double bag food/meat products
- Target sprays that include a repellent when spraying around a trash bin (CHEAP Citronella Oil)

Vertical Barriers and Fly Dispersal

- Vertical barriers: any barrier that is placed in a manner in which it disrupts insect movement
  - Ex: Tree lines, bushes, artificial vertical structures etc.

Risk Factors for Dissemination of Pathogens From Livestock to Food Plants by Flies

- Shedding of pathogens in feces
- Moisture
- UV radiation
- Proximity to animal facilities, particularly confined animals
- Attraction to plants

Questions