Entomology 156: Biology Of Parasites
The Arthropod Parasites Lecture 6. RB Kimsey
The Blood Feeding Flies

I. The mosquitoes- family Culicidae
   A. Introduction
      1. Systematics- 4 subfamilies
         a. Anophelini- Example Anopheles gambii complex of species
            1) Vectors of malaria
            2) Fresh, brackish and salt water forms

1. Systematics- 4 subfamilies
   b. Sabethini- example Weomyia smithi
      1) Larvae in pitcher plants in NE US
      2) Numerous in tropics

1. Systematics- 4 subfamilies
   c. Culicini
      1) Common ubiquitous mosquitoes
      2) Aedes aegypti the yellow fever mosquito
         a) Artificial container, domestic species
         b) Vector of urban yellow fever

I. The mosquitoes- family Culicidae
   B. Biology and Life history
      1. Eggs
         a. On or near water
            1) Singly or in rafts
            2) Floats, hydrophobic
         b. Edge of water, below high water mark

B. Biology and Life history
   1. Eggs
      c. Diapause
      d. Hatching triggers
         1) Photo period
         2) Conditioning (wetting and drying)
         3) Water with low oxygen tension

B. Biology and Life history

2. Larvae
   a. Growth and feeding stage
   b. Four larval molts
   c. Food
      1) Suspended in water
      2) Debris in the surface
      3) Graze on submerged surfaces
      4) Predatory

B. Biology and Life history

2. Larvae
   d. Morphology- adaptation to various respiratory and feeding modes
      1) Suspended feeders
         a) Hang from surface
         b) Respiratory siphon

B. Biology and Life history

2. Larvae
   d. Morphology- adaptation to various respiratory and feeding modes
      2) Linear surface feeders
         a) Palmate hairs
         b) No siphon

B. Biology and Life history

2. Larvae

d. Morphology- adaptation to various respiratory and feeding modes

3) Slug-like predators

4) Siphon adapted for respiring from plant tissue

B. Biology and Life history

2. Larvae

e. Habitats and ecology

1) Found in all kinds of water

2) Aquatic specializations

a) Artificial containers

b) Tree hole

c) Snow pool

d) Flood water

e) Natural containers -rain forest

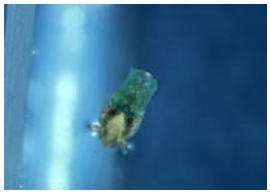
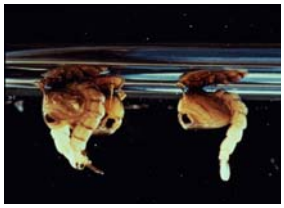
B. Biology and Life history

2. Larvae
   e. Habitats and ecology
      2) Aquatic specializations
         f) Rock pool
         g) Swamp forest pool
         h) Permanent swamp and lake shore
         i) Pitcher plants



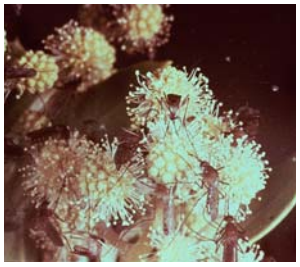

B. Biology and Life history

3. Pupa- non-feeding transitional stage
   a. Active
   b. Respire through thoracic trumpets

B. Biology and Life history

4. Adults
   a. Carbohydrate feeding in both sexes
      1) Sugars from flowers
      2) Extra floral nectaries
      3) Fruit



B. Biology and Life history

4. Adults
   b. Blood feeding females
      1) Zoophilic- feed mostly on animals
      2) Anthropophilic- feed mostly on human
      3) Non specialists
      4) Seasonal shifts in feeding preferences

B. Biology and Life history

4. Adults
   c. Periodicity
      1) Most are crepuscular or nocturnal
      2) Boreal mosquitoes are diurnal
   d. Favored feeding situations
      1) Endophilic- prefer to feed indoors
      2) Exophilic- prefer to feed outdoors

B. Biology and Life history

5. Mating
   a. Immediately after emergence
      1) Swarms
      2) Location by visual, audio, olfactory
      3) First mating only is effective
   b. Some species are refractory to immediate post emergence mating

C. The blood meal- usually required to lay eggs

1. Autogenous- ovarian development and egg laying without blood meal
2. Anautogenous- require blood meal before ovarian development

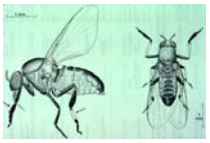
D. Examples

1. Aedes vexans
   a. Common flood water species
   b. Bridge vector of EEE
   c. Feeds on almost any animal
   d. Vectors of arboviruses, bird malaria, dog heart worm
2. Culiseta- Example is Culiseta melanura
   a. Feeds almost exclusively on birds
   b. Enzooitic vector of EEE
   c. Breeds in swamp forest pools

II. The Black flies, Simuliidae

A. Introduction 1000 species
   1. Major genus- Simulium
   2. "Species" cytotypes and complexes

B. Distribution
   1. World wide- common in temperate and subarctic zones
   2. A few tropical species



C. Biology Life history- breed in shallow torrents

1. Eggs- laid attached or loose
   a. Laid loosely at waters edge, on surface, or dropped on surface during flight
   b. Attached to plants, rocks and logs in splash zones
   c. 150-800 per female
   d. Hatch in 3-14 days or over winter

C. Biology Life history- breed in shallow torrents

2. Larvae free living ~6 instars
   a. Thoracic and caudal suckers with hooks for attachment to surfaces
   b. Secrete silk for additional anchorage, life line

C. Biology Life history- breed in shallow torrents

2. Larvae

c. Habitat

1) Riffle zones of streams, rivers, few in stagnant water

2) Downstream side of rocks, logs and debris

3) Certain species attach to Crustacea or insects

C. Biology Life history- breed in shallow torrents

2. Larvae

d. Feed as omnivorous on aquatic micro biota

1) Graze

2) Filter

f. Life span is 7-20 days or over winter

C. Biology Life history- breed in shallow torrents

3. Pupate in shoe-shaped silken cocoon

a. Two days to 4 week pupal period

b. Same aquatic habitat as larvae

c. Gills (respiratory filaments)

d. Adult rapidly emerges- rises to surface in hydrophobic meniscus

C. Biology Life history- breed in shallow torrents

4. Adult biology
   a. Generation time is 8-15 weeks
   b. Adults live 2-3 weeks
   c. Foods
      1) May fly 10 to 20 Km in search of blood (Females)
      2) Both sexes take carbohydrates
      3) Some species are autogenous

C. Biology Life history- breed in shallow torrents

d. Mating
   1) Male swarms over breeding sites
   2) Parthenogenesis (rare)

C. Biology Life history- breed in shallow torrents

e. Morphology
   1) One to 6 mm long
   2) Color highly variable (rarely entirely black)
   3) Stout, not mosquito-like

   4) Broad iridescent wings, veins indistinct posteriorly
   5) Short blade-like mouth parts, greatly reduced in males

D. Host relationships and feeding

1. Host relationships
   a. Broad host ranges
   b. Some host specific – Anthropophilic
2. Feeding behaviors
   a. Blood feeding process poorly known- pool from lacerating dermal capillaries
   b. Diurnal, outdoor biters
   c. Swarm feeders