GMCA Meeting 2005

1. Darold Batzer (UGA) – Management of River Floodplains in the Southeast: Consequences for Mosquitoes
    - Impact – logging changes forest to open habitat
    - Using "Best Management Practices"
    - Study – Coosahatchee River
        - Control – no cut
        - Deferment – left islands of trees
        - Clear cut
    - Data collected at study sites
        - all aquatic invertebrates – variation in control based on hydrology, partial cut similar to control, clear cut varied greatly
        - crustaceans only – essentially eliminated in clear cut areas
        - snails only – essentially eliminated in clear cut areas
        - mosquito larvae – increased greatly in clear cut areas
    - River regulation
        - Altamaha River – mostly unregulated
        - Savannah River – mostly regulated (eliminates extremes)
    - Data collected at river floodplain sites
        - all aquatic invertebrates – differences seen in aquatic communities between two rivers
        - lots of dyticid beetles in Altamaha River
        - fingernail clams absent in Savannah River
        - lots of Psorophora spp larvae (and others) in Savannah River floodplains
        - more water is going to be put back into the Savannah River floodplains to increase community diversity and (hopefully) decrease numbers of mosquito larvae

2. Lisa Calhoun (CDC) - Combined Sewer Overflows as Breeding Sites for Culex quinquefasciatus, Vector of WNV in the Eastern US
    - CSOs release essentially untreated sewage into steams during storm events
    - CSOs in Atlanta completed about 1920 (11 basins)
    - >700 CSOs in major cities in the US
    - Objectives
        - Longitudinal study – Tanyard Creek
        - Characterize habitat types
        - Quantified mosquito stage using 25 random dips per habitat type per week
    - Species collected – quincs, restuans, nigripalpus
    - Different densities of various stages observed at different habitat sites
    - All stages found primarily in stagnant water but could be found in flowing water
    - All stages found in but sunny and shady areas, but they preferred shade

- ❖ Flood events have a negative impact on all stages but do not eliminate mosquitoes from the CSOs
- ❖ More larvae found in side pools than at the banks of the creek or within the creek

3. Acacia Cognata (Emory) - Evaluating Neighborhood Clean-ups for the Control of *Aedes albopictus*
    - ❖ Atlanta Metro area divided into 24 Neighborhood Planning Units (NPUs)
    - ❖ Roles
        - City of Atlanta
        - SWIFT (Fulton County)
        - NPUs
    - ❖ Evaluations done in 2 NPUs (J and W) – selection based on census demographics and amount of WNV activity
    - ❖ Target Population
        - single family homes
        - pre and post info (KAP) surveys done at randomly selected homes
        - pre and post pupal surveys
        - adult trapping
    - ❖ Issues
        - census demographics were not correct; sites not all that similar
        - differences in number of pupae found
    - ❖ Findings
        - tires most common breeding sites in NPU-W along with small plastic containers
        - plant pots most common breeding site in NPU-J along with small plastic containers
        - *Aedes albopictus* most common species found
        - Immediate decrease in adult *Aedes albopictus*

4. Bill Irby (GSU)- Equine WNV Infections in Rural SE Georgia
    - ❖ Study site in SE Georgia
    - ❖ Sampling done 1-2 years after the case was detected
    - ❖ Sampled 2 weeks prior to onset date, on onset date, and 2 weeks after onset data
    - ❖ Used dry ice baited CDC light traps (one near barn, one at woodland edge)
    - ❖ vacuum aspirator samples in all out buildings
    - ❖ settings primarily open fields with woodland edge
    - ❖ 75% CFR for WNV in horses in this area
    - ❖ about 23 species found, primarily *Cx. nigripalpus*, *Cx erraticus*, *Aedes vexans*
    - ❖ *Cx nigripalpus* found at all sites
    - ❖ no positives found (VecTest)
    - ❖ Is *Cx nigripalpus* the culprit?? Will feed on both birds and mammals

- ❖ Horse Behavior Study
  - Looked at pairs of horses – one never infected, one infected and recovered
  - horses previously infected had fewer defensive behaviors but it is not significant
  - most common insect collected was tabanids (deer fly)
- ❖ No gravid trapping done

5. Ronnie Robins (Clayton County) – Clayton County Mosquito Control
   - ❖ Initially – adulticiding at complaint sites
   - ❖ Went to scheduled adulticiding based on county commission districts
   - ❖ Now combining larviciding & adulticiding with some surveillance, some complaints, and scheduled sprays

6. Ronn Grace (East Metro Health District) – WNV Surveillance Program
   - ❖ Planning
     - create protocols
     - review and adjust action levels
     - agreements needed with partners (Memo of Agreement)
   - ❖ Action Levels
     - based on data
     - need to be reviewed regularly
   - ❖ MOAs
     - funding & support
     - partnerships with businesses, municipalities, and government agencies
     - public relations/communications support
     - monitor/data keeping
     - mapping
   - ❖ Education is Primary!!!
   - ❖ Challenge of adulticiding

7. Ray Noblet & Marianne Robinette (UGA) – Connecting Students with Mosquito Control Projects in Georgia
   - ❖ new dean at college
   - ❖ Marianne Robinette is program manager for internship programs
   - ❖ need request for student early (before May)
   - ❖ entomology opportunities
     - undergrad research
     - internship
     - hourly worker
     - job after graduation
   - ❖ timeline for internship
     - fall semester (Aug-Dec): Feb 1st
     - spring semester (Jan – May): Oct 1st

        - summer semester (May-Aug): Feb 1st
    - ❖ Send position announcements to university (contact Elmer or Marianne Robinette)
    - ❖ Info is sent out to students via flyers and email
    - ❖ entomolo@uga.edu (Marianne Robinette)

8. Christina Pasa (Coastal Health District) – Public Health and Mosquito Control
    - ❖ monitor vector-borne diseases
    - ❖ deal with human cases
    - ❖ collaborate with community partners - prevention
    - ❖ provide stats
    - ❖ EDUCATION
    - ❖ Risk Factors
        - ecological: die off of salt marsh, urban sprawl, forestry
        - man-made: dredge areas
        - weather-related: hurricanes, flooding
        - high variety of mosquito species
    - ❖ Tourism!!!
    - ❖ How does mosquito control help the district…
        - communicate needs
        - information about mosquito activities, surveillance, etc
    - ❖ How does the district help mosquito control…
        - info about human disease
        - mapping
        - assist with funding
        - collaboration with press releases / education
        - rumor control
        - program promotion
        - help with handling public concerns and inquiries
    - ❖ PARTNERSHIP

9. Elmer Gray (UGA) – IPM and the Mosquito Control Category
    - ❖ Georgia Extension Service
        - Georgia Pest Management Handbook
        - Summary of Insect Control and Losses Estimate
            - $74,000,000 related to heartworm alone
            - $125,000,000 related to mosquito control
        - Pesticide Applicators – mosquito control category (NEW)
            - Currently the pesticide applicators licensing requires taking the public health test
            - Working towards a mosquito control specific category
            - Will still require taking core course
            - Creating a manual – important resource
            - test will relate to **MANUAL**
    - ❖ Good understanding of mosquito control is vital

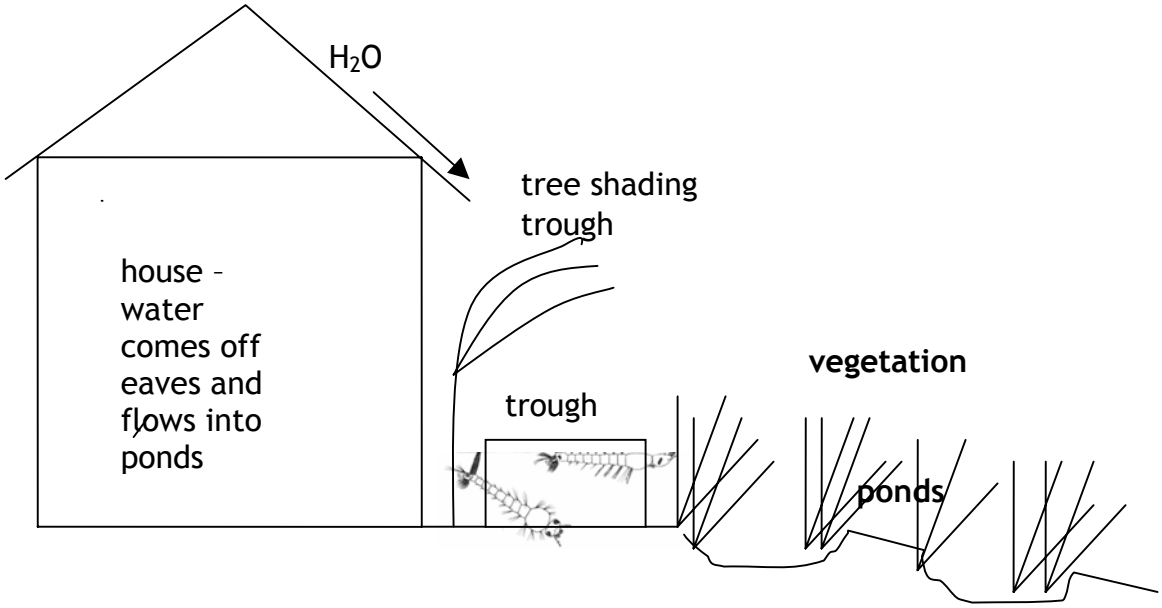
- mosquito biology
- mosquito surveillance
- mosquito suppression (control)

- History of mosquito control in Georgia
  - Ft King George 1721 (Darien GA)
  - reports of mosquito problems
- Info on GMCA
- Chap 1 – Classification and Biology of mosquitoes
- Chap 2 – Ecology and Identification
- Chap 3 – Mosquitoes as Vectors of Disease
- Chap 4 – Integrated Mosquito Management
- Chap 5 – Program Operation
- Chap 6 – Arthropods of Public Health Importance
- Additional Topics
  - terminology
  - GA mosquito field guide
- ewgray@uga.edu
- IPM - first described in 1969
  - use all available resources
  - balance between reducing economic damage and preventing ecological side effects
  - circumstances dictate how mosquito control is done
  - EDUCATION EDUCATION EDUCATION
    - mosquito biology
    - mosquito prevention information for homes and neighborhoods
    - web sites
    - slogans
    - personal protection
  - How to get the message out
    - brochures
    - mailings (thru water bills)
    - ads
    - mascots
    - public service announcements (radio or TV)
    - community clean-up projects
    - chamber of commerce
    - city managers
    - Adult groups – community or neighborhood groups, environmental groups, AARP
    - schools, clubs, scouts (teach the kids)
    - bug mobile – targets 5th graders (LA County program)
    - churches
    - promote public responsibility
  - Neighborhood Clean-up Programs
    - spring clean-up campaigns

        - tire amnesty
        - river clean-up
        - promote helping neighbors
        - cost-effective and environmentally friendly
        - community fairs (effectiveness – good PR)
    - enforcing ordinances is important
- ❖ mosquito-borne diseases are preventable
- ❖ surveillance is critical, but can be difficult to do

10. Aparna Telang (UGA) – Nutritional Mediation of the Endricrinology of Mosquito Egg Development
    - ❖ larval ecology influences female fitness (survival & reproduction)
    - ❖ focus has been on anautogenous species (must ingest blood for all egg cycles), primarily *Ae aegypti*
    - ❖ nutrition and hormones are both important in egg cycle regulation
    - ❖ blood meal initiates a hormonal cascade
        - blood meal sends a message to the brain
        - hormone (insulin? OEH?) released
        - ovary stimulated to produce ecdysteroids
        - fat body stimulated to reduce vitellogenin
        - ovaries stimulated to produce yolk
        - eggs are the result
    - ❖ this research uses an autogenous species (egg cycle does not require a blood meal – sometimes just the first egg cycle) *Oc atropalpus*
    - ❖ in autogenous species, egg laying depends entirely on larval nutritional reserves
        - larval nutrition affected body weight in both species
        - larval nutrition affected only lipids accumulation in aegypti but affected glycogen and proteins in atropalpus
        - strong relationship between body size (nutrition) and number of eggs laid
        - juvenile hormone involvement in aegypti, but not in atropalpus – related to larval nutrition
        - ecdysteroid capacity reduced in females with low nutritional reserves – delays egg maturation; sugar meals restore hormone production
    - ❖ hypotheses
        - tissues store nutrients (lipid, glycogen, protein) and convey to nervous system that nutrients are available
        - high G & P lead to egg production without a blood meal
        - low G & P lead to arrested development of eggs until a blood meal is taken
        - low lipids require a nutritional boost via a sugar meal to promote egg development

11. Jeff Jackson (GA) – Musings of a Naturalist
    - ❖ Backyard ponds and mosquitoes
        - lots of diversity = fewer mosquitoes
        - shaded ponds = less diversity = more mosquitoes



    - ❖ solutions to mosquito problems
        - Bti
        - advanced succession in the sun
        - fish
        - tadpoles?? – don't seem to eat larvae (toxic tadpoles??)
    - ❖ sunny ponds will produce mosquitoes, but usually not nuisance species
    - ❖ shaded containers produce nuisance species and don't really have vegetated succession

12. Sam Gibbs (SCWDS) – Avian Indicators of WNV in Georgia
    - ❖ >300 species found to be infected throughout the US
    - ❖ corvids most susceptible to clinical disease
    - ❖ others get infected but do not get clinical disease
        - northern cardinal
        - rock dove
        - common ground dove
    - ❖ objective – look for good avian indicator species and look for variables affecting the distribution of WNV in Georgia
    - ❖ looked at percent cover throughout a 1 km distance
    - ❖ study done over a 3-year period

- seroprevalence increased slowly over the 3 years
- WNV increased in prevalence throughout the state
- land use has an affect on seroprevalence (may have to do with sample size)
- logistic regression
    - all included – year, age, land use, species are important
    - different variables are important depending on species
    - for distribution of WNV – land use type, Jan temp, elevation important (more likely to find WNV in urban/suburban areas, less likely to find WNV in areas of higher elevation
- GA – 37 species found positive, best avian indicator for SE is Northern cardinal
- Demographic and environmental effects are decreasing in importance as WNV spreads throughout GA

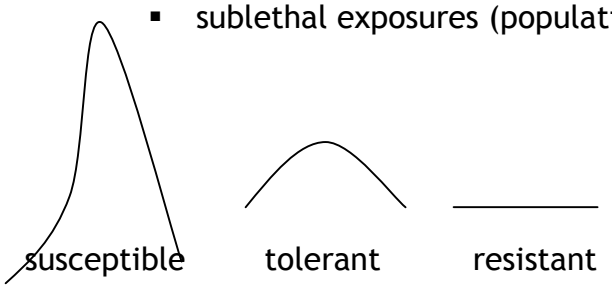
13. Chris Evans (SC DHEC) – Update on WNV & Other Vector-Borne Diseases in South Carolina
    - use primarily CDC light traps & gravid traps
    - 25 organizations involved in mosquito surveillance – vector specialists in health departments
        - health departments
        - mosquito control
    - 147 surveillance sites in 33 counties
    - quincs 21% of mosquitoes tested
    - corvid testing done with oral swabs
    - primarily tested corvids (60% blue jays), but did test other species occassionally
    - testing mid April - mid November; 141 birds from 34 counties
    - human testing – 142 tested from 12 counties
    - WNV+: 4 humans, 35 birds, 25 mosquito pools, 0 horses
    - distribution of cases has been spotty in 2005
    - put out advisories based on MIR
    - all counties but one have had WNV activity since 2002
    - lots of EEE activity in 2005
    - EEE+ *Cs melanura* & *Cx erraticus* found
    - *Anopheles crucians* complex is a competent vector for EEE???
    - www.scdhec.gov/westnile

14. Peter Nunn (Ft Stewart) – Comparison of CDC Light Trap to Black Hole (UV) Traps
    - traps used – CDC light trap with CO2, Black Hole UV Traps, CDC light trap
    - Black Hole UV trap produces CO2 - tested same as ambient air
    - 2 experimental designs – year long randomized design and a 5-day block design (3 locations each)
    - 3 location types – housing area, horse barn, golf course
    - Black Hole trap had more consistent light output at a distance

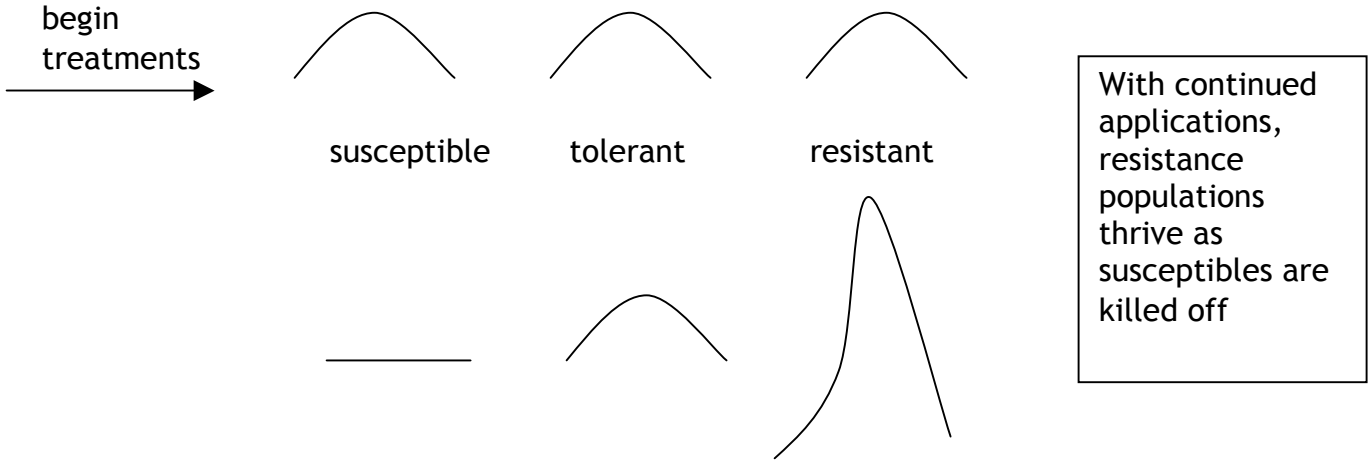
- UV light trap caught more total mosquitoes
- more species caught in baited CDC light trap
- UV light trap caught more of each species that both traps caught
- UV light trap collects gravid females at a much higher level than the baited CDC light traps
- Comparison
    - Black Hole trap
        - no CO2
        - needs a power outlet
        - must be protected
        - high numbers
        - gravids
    - baited CDC light trap
        - CO2
        - battery
        - lower numbers
        - no gravids
- traps set up high – is this an issue

15. Joe Conlon (AMCA) – Legislative Update
    - permethrin risk assessment is out
    - Boxer Amendment – bans testing of pesticides on humans
    - Otter Bill – larvicides and the Clean Water Act
    - Interim Guidance for Mosquito Control on National Wildlife Refuges

16. David Dame (UFL) – Insecticide Resistance in Mosquitoes
    - >500 resistant insects worldwide by 1985
    - both behavioral and physiological resistance seen
    - need to conserve the products we currently have
    - What is resistance? – pesticide no longer kills pest when it did before
    - How does resistance occur?
        - increase in detoxifying enzymes (oxidases, esterases, transferases, ect) - genetic
        - altered action site – genetic
        - reduced insecticide penetration – genetic
        - sublethal exposures (population effect)



Pesticide resistance in an untreated population



- predisposing factors
  - several generations per year – more applications/more exposure
  - high dose rate – eliminate susceptible
  - prior exposure to pesticide with similar mode of action
  - isolation of population – need refuges
  - agricultural insecticides
- protecting against resistance
  - low product persistence
  - lose dose rate
  - lowered fitness of resistant types
  - mode of action – adulticide vs larvicide
  - localized applications
  - selection can occur at either high or low dose rates
- Is it really resistance?
  - poor formulation
  - wrong droplet size range
  - poor timing of spraying
  - adverse environmental conditions
  - unexpected operational failures to expose
- Confirming resistance
  - CDC bottle assays - adults
  - cage trials - adults
  - microplate analysis of resistant species – need to know what is causing the resistance, some can be overcome
  - lab exposure – larvae
- Resistance Management / Susceptibility Maintenance
  - source reduction, biocontrol
  - low application frequency
  - low rate if no disease, less than LD_{100}

        - alternate adulticide classes
        - tolerate high population levels
        - leave untreated areas
        - when resistance has started, make R allele functionally recessive by:
            - higher doses vs RS
            -
        - use multiple pesticides / pesticide mixtures
            - reduced dosages of each
            - rotate insecticides
            - SR & RR alleles less fit
            -
    - Monitoring
        - localized resistance (focal) – multiple sampling sites required
        - agricultural impact – class switching may be needed
        - establish baselines
        - monitor at least annually – date of sampling needs to be consistent
        - pool biochemical monitoring resources to reduce cost
    - Bti is probably the only exception to the resistance rule – all other pesticides can produce resistance in the pest population

17. Mike Leahy (Clarke Mosquito Control) – Choosing Larvicides
    - larvicides are agents applied directly to water where mosquito larvae are found to prevent the larvicides from becoming adults
    - Larvicides are part of an IPM approach
    - Larvicides are part of the CDC phased response to reduce vector-borne diseases
    - need to confirm the presence of larvae before treatment (Seven Ways to a Successful Dipping Career)
    - What do you need to know
        - which species
        - what is the specific goal
        - budget
        - what larvicide compliments the adulticide being used (ex//temephos use when OPs are used as adulticding)
        - what equipment is needed
        - what formulations are best for the problem
    - formulations
        - briquettes/ingots – easy to apply, residuals, continual broods
        - WSP – easy to apply, residual, CBs
        - granules (CG, G, SG, BG) – easy to apply, single brood and residual
        - pellets – easy to apply, residual
        - liquids – WDG, AS, EC, oils
    - what products are available

        - natural predators – fish
        - BT products – various formulations
            - Bti – stomach poison, kills all species, good at many sites, doesn't work well in heavily organic waters, extremely low toxicity/high specificity
            - *Bacillus sphaericus* – 30 to 35 day residual, good for heavily organic waters, works best for *Culex* spp, *Aedes vexans*, some *Psorophora* spp
        - IGR products – methoprene
            - residuals
            - kills all species
            - juvenile hormone mimic - interrupts development
            - good at many sites
            - various formulations
        - temephos products
            - OP
            - contact control agent
            - all species
            - fast acting
            - good single brood product – can have residual formulations
            - can be used where there are no fish or other beneficial aquatics
            - various formulations
    - work with reputable suppliers
    - educate yourself
    - do small scale trials
    - READ THE LABEL

18. Ben Brewer (UGA) – Oviposition Monitoring in Athens
    - quinc/restuans seasonal population transition and its relation to disease transmission
    - Flanders virus – found in spring and fall
    - WNV – found in the summer
    - collection done at a variety of habitat sites
    - sampling
        - collected weekly
        - larvae grown to late instar
        - 200 larvae randomly sampled for ID from each site
    - easier to distinguish quincs from restuans at the larval stage
    - total # larvae ID'ed – 37,296+
    - total of nine species ID'ed
        - *Cx restuans, quincs, Ae albopictus, Cx territans, Cx nigripalpus, Oc triseriatus, Tox, Anopheles, Oc japonicus*
    - both restuans and quincs present at some level most of the season
    - population structure does change

- ❖ switch from restauns to quincs occurred about mid-June and switched back about mid-Sept
- ❖ Flanders virus seems to be found when restuans are high

19. Wayne Gardner (UGA) – Red Imported Fire Ants in Georgia
    - ❖ Problem/Impact
        - total cost - $5.7 billion annually
        - control & treatment - $1.6 billion
        - medical/vet - $100 million
        - repair & replacement - $3.8 billion (loosen dirt under roadways causing potholes, damage to contact junction boxes
        - crop damage - $277 million
        - wildlife impact - ???
        - habitat changes - ???
    - ❖ Biology
        - worker size varies
        - bite & sting – varying allergic reactions occur
        - caste system with changing jobs for workers as they mature
        - brood – immatures
        - will tend aphids
        - mounds can get very large above and below ground
        - size of mounds is temperature dependent and will vary
        - seek solar radiation to warm brood
    - ❖ Survival strategies
        - flood adapted – float in large groups
        - aggressive predators
    - ❖ Invasion
        - came in from South America (Brazil?) in 1931
        - got into Georgia in 1958
        - most of GA invested in 10 years
        - still heading north – current range includes Texas east to NC, sites in California
        - potential range includes all of the southern US and up along both coasts (except where it gets very cold)
    - ❖ Control
        - contact poisons (granules, dusts & drenches) – acephate, deltamethrin, carbaryl, diazinon, esfenvalerate, permethrin, citrus oil, fipronil
        - baits (slow kill) – abamectin, fenoxycard, hydramethylnon, indoxycarb, methoprene, pyriproxyfen, spinosad
        - natural enemy
            - phorid fly – parasitoids specific to specific size of specific fire ant species
                - ➢ egg laid in thorax
                - ➢ pupa forms in head – decapitates ant

        - workers will refuse to forage when they hear the wing beat frequency of the fly
        - flies cued in to ant alarm pheremone
    - thelohania fire ant disease (protozoan) – reduces fitness of colony
    - Fire ant natural enemy release programs are occurring – flies are establishing and spreading, disease has established but does not seem to be spreading in GA (single queen colonies)
- Black Imported fire ant is also here in the more northern areas – hybridization is occurring (seem to be more cold tolerant)