Turf Insect IPM

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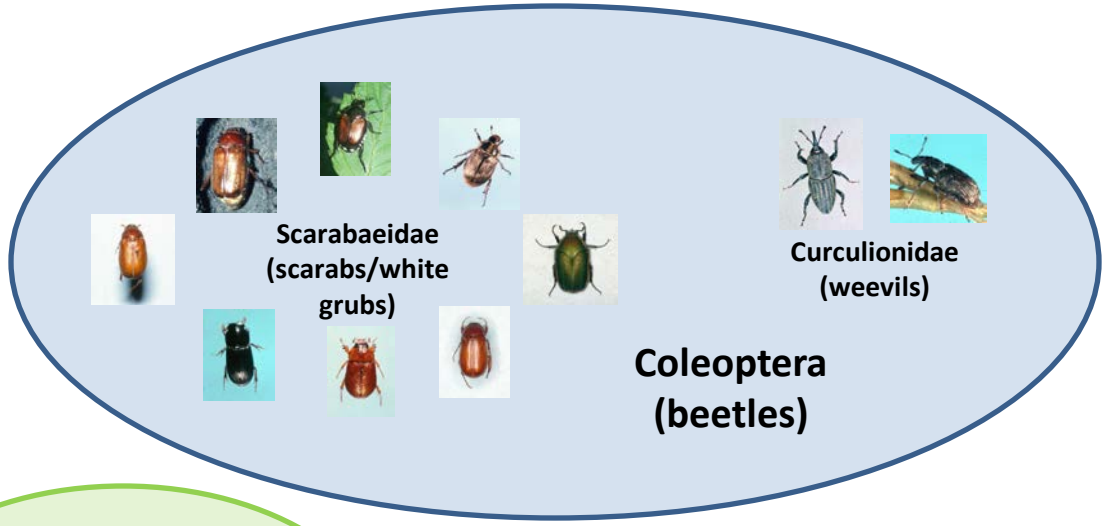
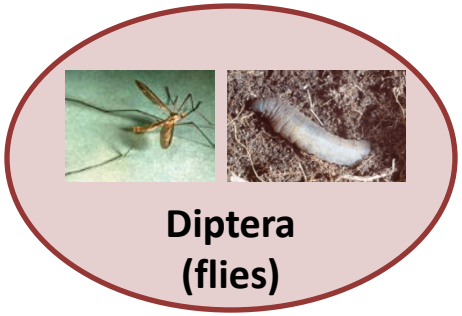
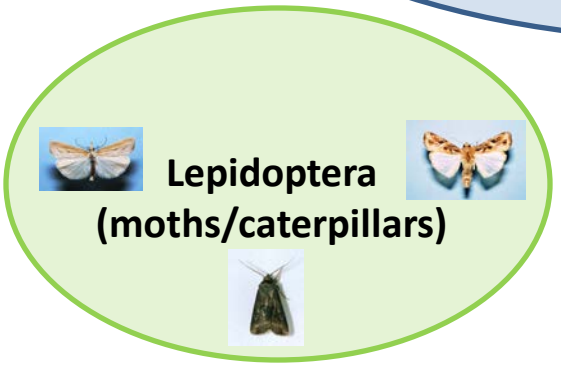
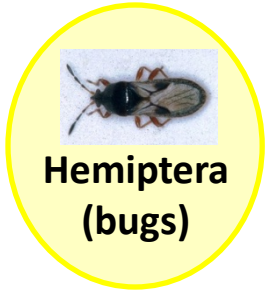
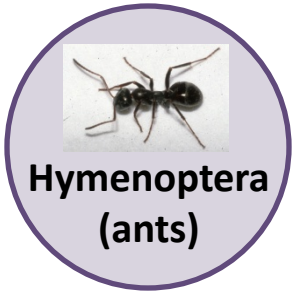
Diversity of arthropods that are pests











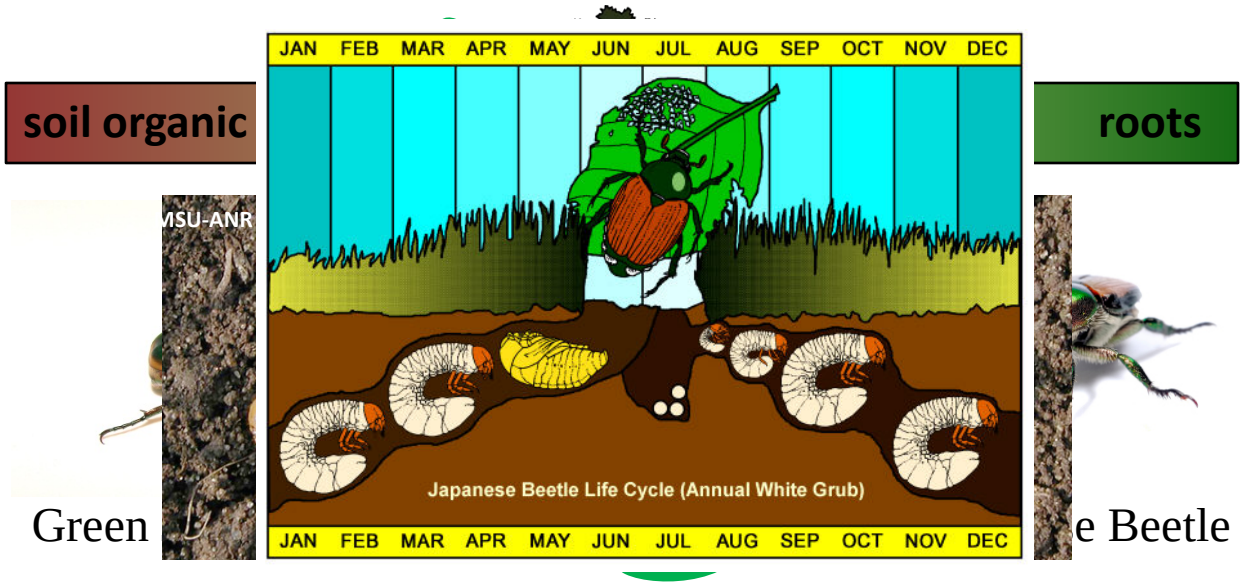
Turf insect diagnostics
-required knowledge/skills-

- Basic Biology
  - Feeding
  - Movement (habitat range/dispersal)
  - Seasonality
  - Reproduction
- Insect identification
- Recognition of damage symptoms
- Field collection skills
  - scouting

-annual white grubs-

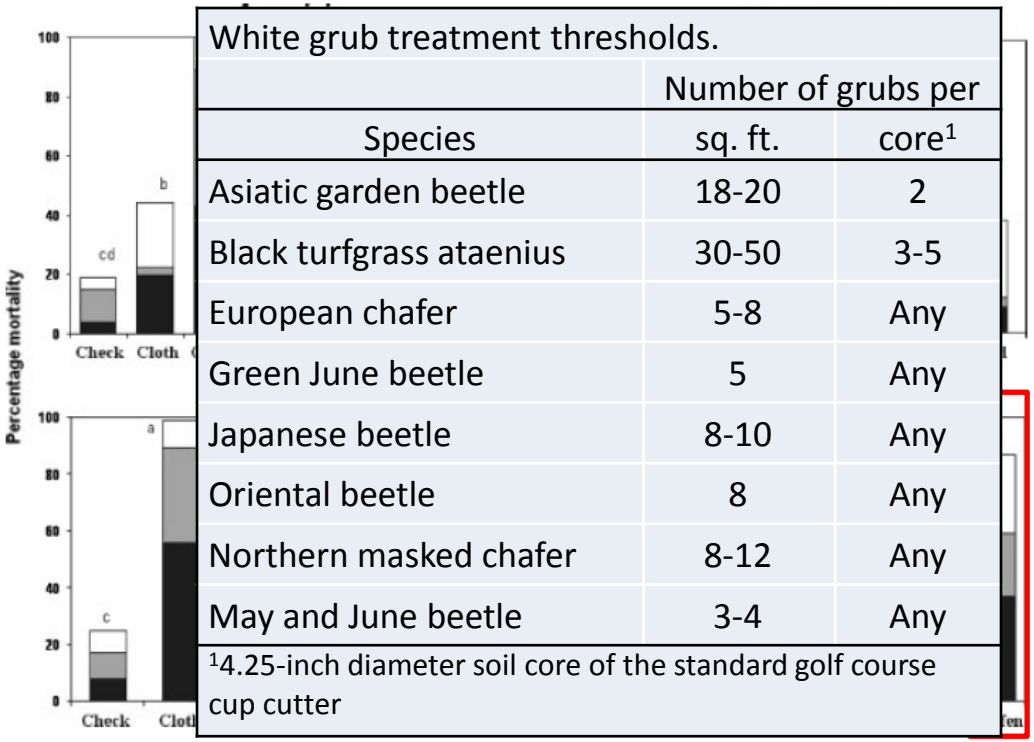
- One generation per year
- Seasonal activity varies among species (e.g. European chafer)
- Feeding preference
  - detritus to live roots
  - varies by development and among spp.
- Adult activity
  - feeding vs. non-feeding

  (JB, AGB vs. EC)



Why identify scarabs in turf?

- white grubs vary in susceptibility by life stage
  - decreases with age
- variable efficacy among different insecticides
- damage thresholds differ



Product	Type
BotaniGard	B. bassiana (bio)

White grub treatment thresholds.

Species	Number of grubs per sq. ft.	Number of grubs per core[1]
Asiatic garden beetle	18-20	2
Black turfgrass ataenius	30-50	3-5
European chafer	5-8	Any
Green June beetle	5	Any
Japanese beetle	8-10	Any
Oriental beetle	8	Any
Northern masked chafer	8-12	Any
May and June beetle	3-4	Any

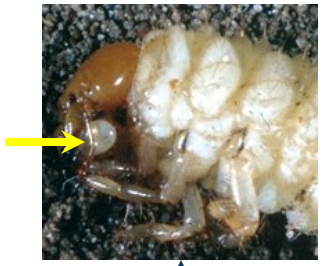
[1]4.25-inch diameter soil core of the standard golf course cup cutter

Diagnosis
-larvae-

- C-shaped larvae
- Size varies considerably among developmental stages and species
- raster patterns are key to identification

Other features:

- Palps on AGB
- Pads on BTA



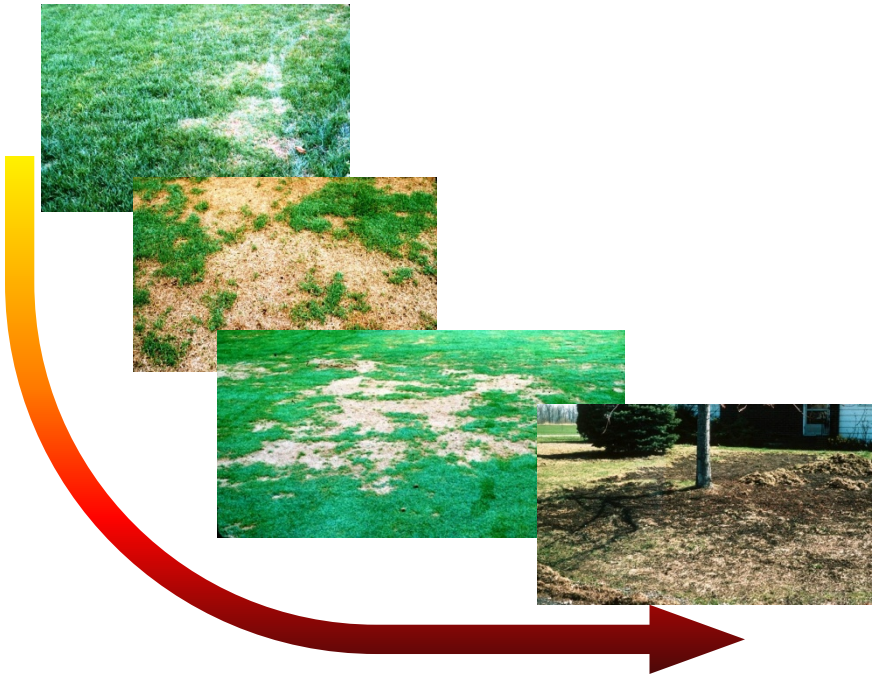
White grubs
diagnosis

Damage (general)

- Turf feels spongy under foot
- Turf with heavily grazed roots will life easily

<u>Stages</u>

- weakness
  - Low tolerance to other stressors
  - slow/no response to irrig. or fert.
- thinning
- extensive dead patches
- vertebrate digging



scouting and decision making

Adults

- Pheromone traps/lures (JB)
- Mating swarms (EC – arborvitae)
- Sweep netting (AGB)

Larvae

- Shovel, sod cutter, turf cup cutter
- Time of year to scout
  - Spring – overwintered larvae, resistant to treatment
  - identify future problem areas and plan for preventive treatments
  - Summer/Fall - curative applications
    - susceptibility decreases with age!

White grub treatment thresholds.

	Number of grubs per	
Species	sq. ft.	core[1]
Asiatic garden beetle	18-20	2
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[1]4.25-inch diameter soil core of the standard golf course cup cutter

Past research has shown that insecticide treatments are necessary only 20% of the time.

treatment options

target larvae

- Preventive
  - Summer
  - Areas with chronic grub populations
  - chlorantraniliprole (Acelepryn)
  - imidacloprid (Merit)

- Curative
  - late summer/fall
  - Imidacloprid (Merit) chlorpyrifos (Anderson Golf Insecticide III)
  - Trichlorfon (Dylox)
  - Entomopathogenic nematodes

Can I do a spring curative grub treatment?

  - Grubs typically highly resistant
  - But…overwintering 2nd instar grubs susceptible
  - healthy turf can outgrow spring damage
  - Spring fert can hinder recovery of grub damaged areas

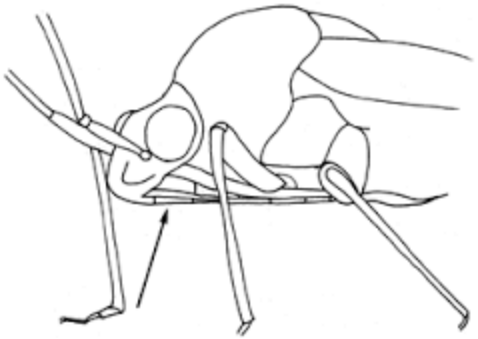
Hairy chinch bug
Blissus leucopterus hirtus

Natural history

- Widespread in NY
- Common in home lawn turf

  - occasionally golf turf
- Prefers thatchy turf
- Sandy soils
- 1yr life cycle upstate NY (2 elsewhere)
  - Adults overwinter in thatch/weeds/litter
- Thatch/ soil surface
- Feeds on crowns and stems
  - Most cool season grasses

Hairy chinch bug diagnosis



General morphology

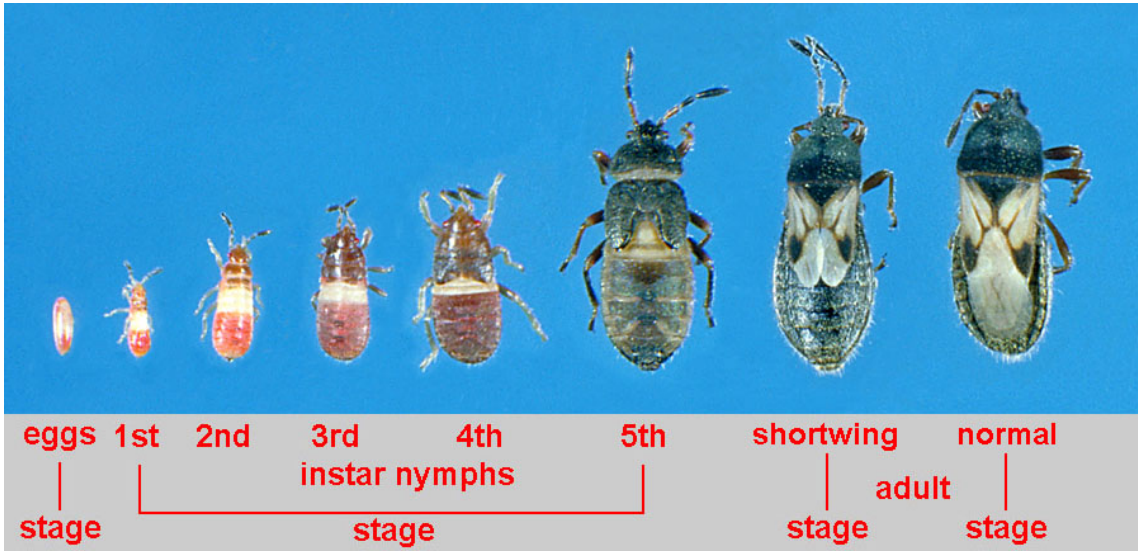
- Fast moving
- Piercing/sucking mouthparts
  - "stylet"

Adults

- 3/16 inch
- Shiny white wings

Nymphs

- wingless
- red-orange-brown
- pungent smell when disturbed



Hairy chinch bug diagnosis

Damage

- July-August
- Appears like drought stress
  - no recovery post irrigation
- yellow – red/brown patches

scouting and decision making

Scouting

- June-August
- At margin of damage area
- Direct observation
- Flotation cylinders in low thatch
- Soil cores
  - submerged in salt water in high thatch
  - Reveals eggs, nymphs, and adults
  - Heat extraction
    - Nymphs and adults only

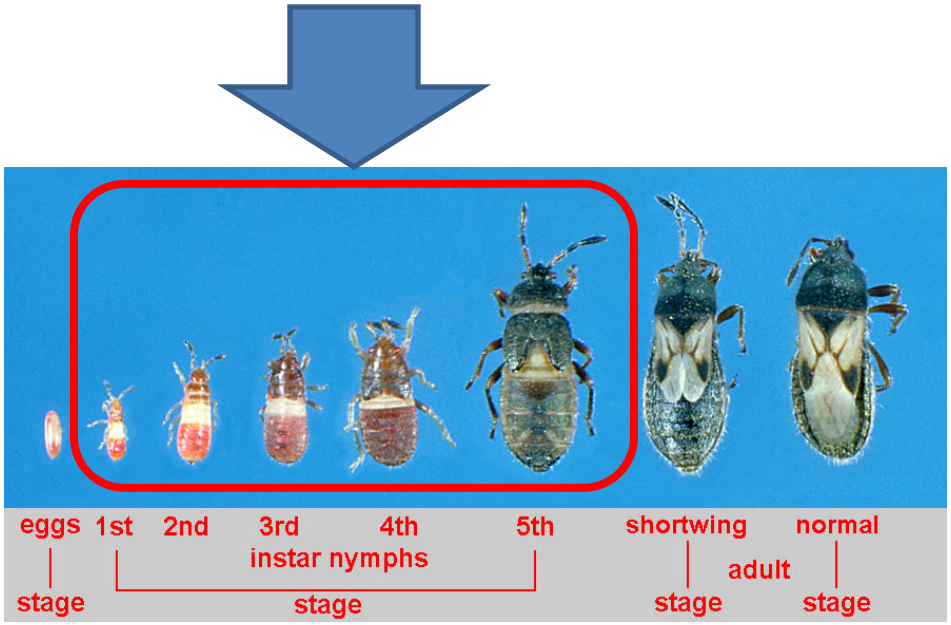
threshold

method	# individuals
Direct observation	10 / 60sec/ ft^2
Heat extraction	20-30 / ft^2
Flotation	20 / cylinder

treatment options

Chemical

- Mid-summer
  - Post egg laying – target nymphs
- Irrigation
- Pyrethroids (bifenthrin, permethrin…)
- Carbamates (carbaryl)
- IGR (azadrachtin)



Cultural

- Endophyte-enhanced seed
- Thatch management

Biological

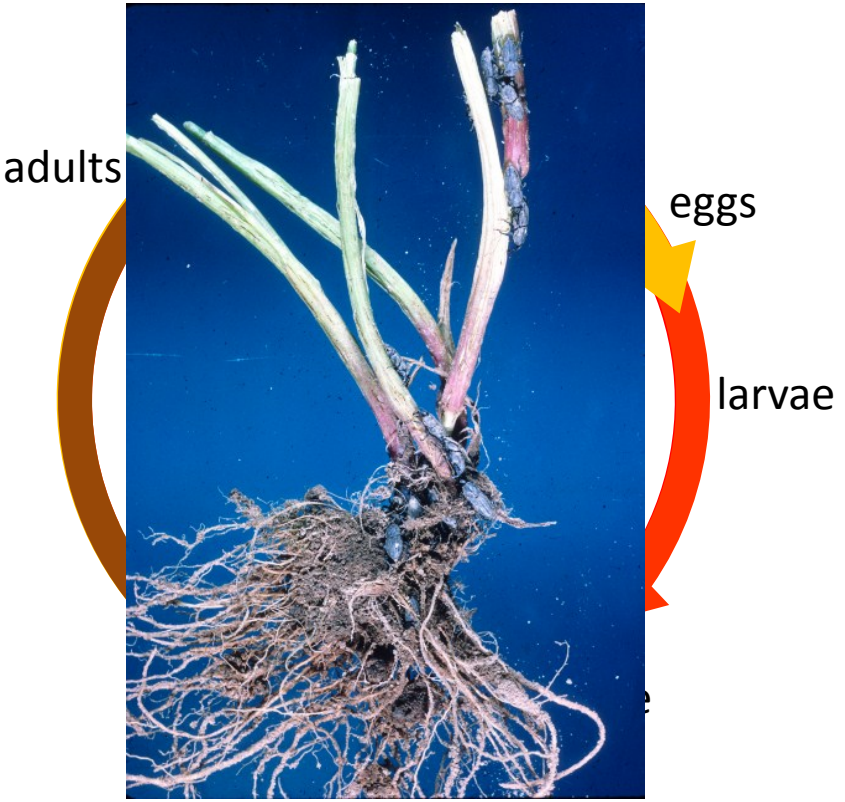
- *Beauveria bassiana*
- *Steinernema carpocapsae*
- Conservation biocontrol – big eyed bug

Bluegrass Billbug

Natural history

- Tall mown turf
- Home lawns, roughs, etc…
- Feeds on diverse turfgrasses (rye, fescue,…)
- Exhibits preference for Kentucky bluegrass

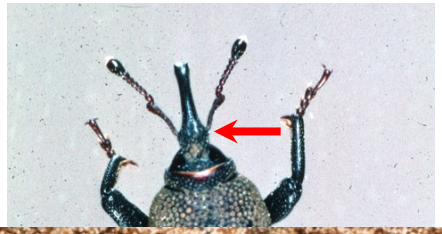
- 1 yr life cycle
  - Overwinter as young adults in leaf litter/weeds etc…often abutting pavement
  - Adults chew stem and oviposit
    - Late spring/early summer
  - Larvae feed progressively downward on plant (stem-to-crown)
    - Mature larvae feed on roots



Bluegrass billbug
diagnosis

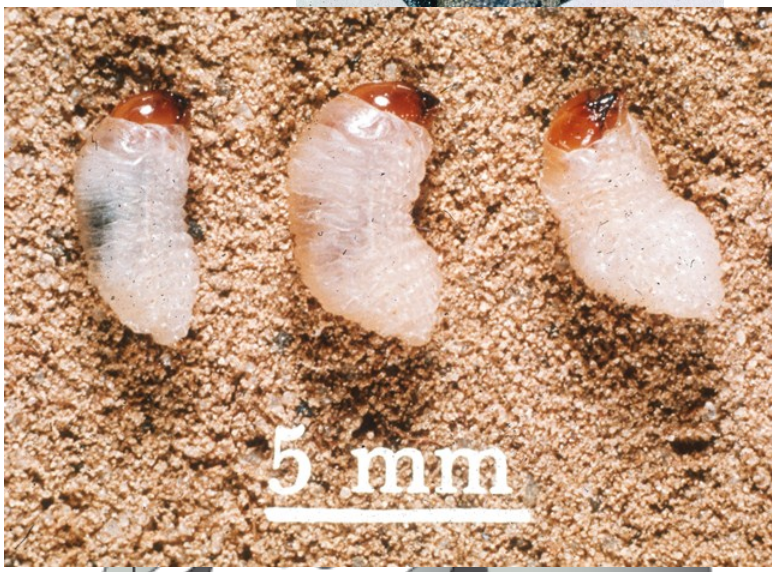
Adults

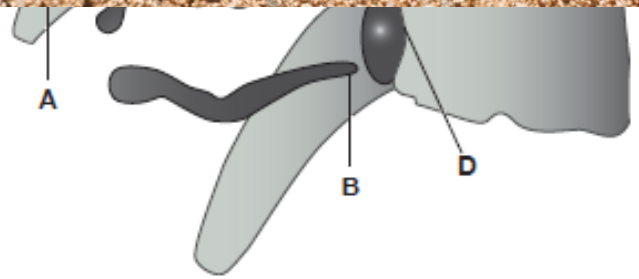
- ¼ inch long (~2x size of ABW)
- antennae attached near eyes
- Dark gray to black coloration
- Often coated in soil



Larvae

- cream/white
- no legs
- 3-8 mm
- brown head capsule
- 5 instars





Peck et al. 2007

Bluegrass billbug
diagnosis

Damage

- Adults – leaf notches
- Larvae – weakened stems
  - tug test
  - Wilted turf
  - Brown/tan frass accumulates around crown and roots
- brown patches starting along driveways, sidewalks, near trees then spreading

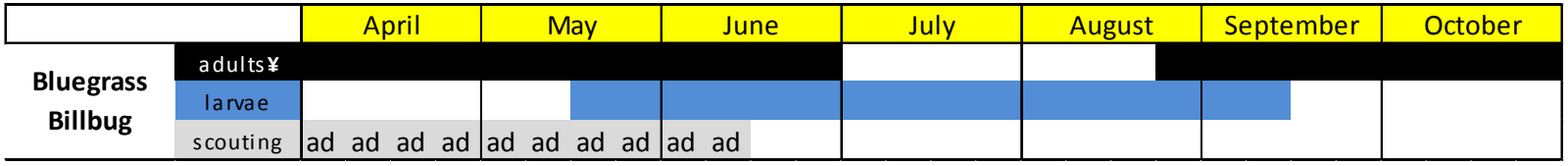
decision making

- Timing is key
  - Adults emerging from overwintering (before egg laying)
  - Or when larvae are young
  - by July/Aug – too late for acceptable control
- Population level

damage threshold

method	# individuals
Pitfall trapping	7-10 adults / 2-3 wks
Observation	>2 adults / min
Larvae	8-12 / ft^2

record keeping



treatment options

Spring adults (preventive)

- Adults prior to egg laying
- May-June (60°F)
- Anderson Golf Duocide (bifen/carbaryl)

Larvae (curative)

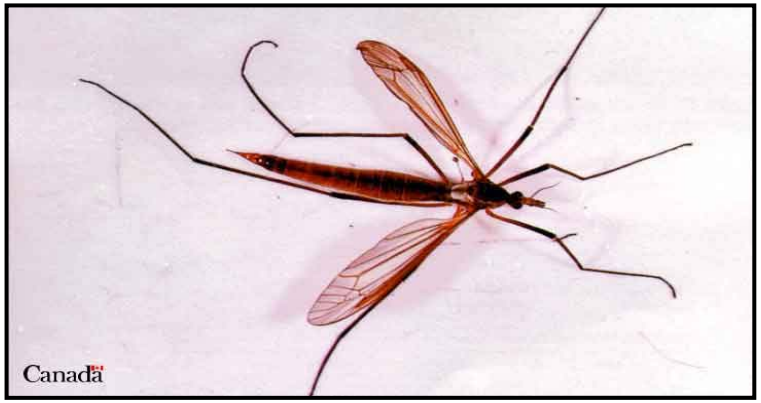
- Carbaryl (Sevin)
  - Often not effective
  - Damage typically already present
- EP nematodes?

European and Common Crane Fly

Tipula paludosa, oleracea

Natural history

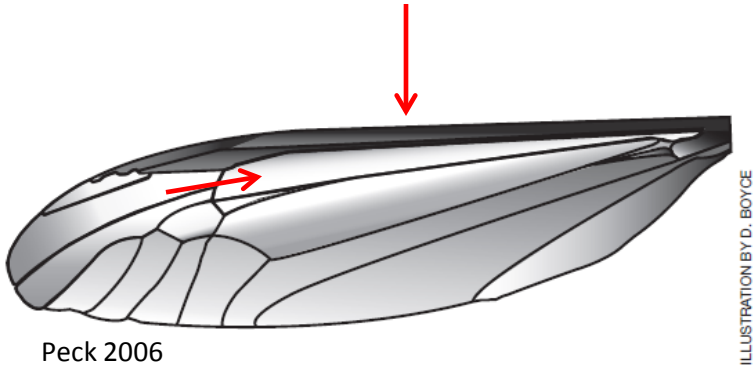
- First recorded as pest in NY – 2004
  - First observed in Erie and Niagara
  - Now present in 18 counties
- Native to Europe
  - >100 native spp. in NY
- 1 (*paludosa*) or 2 (*oleracea*) gen/yr.
- Feed primarily on roots, but will also surface to feed on crowns, stems, blades
  - high-low maintenance lawns, golf courses, sod farms…



Crane Flies diagnosis

Adults

- 2-3 cm long
- Dark smoky band on leading edge of forewing
  - Followed by light band
  - No other wing patterning
    - contrast with native crane fly
- Sexes differentiated by terminal abdominal segmentation



Peck 2006

Most native crane flies have more elaborate patterning on wings

Gayle and Jeanell Strickland (iz.carnegiemng.org.cranefly.idkeys.htm)

Crane Flies diagnosis

Larvae

- gray-green
- opaque cuticle
- posterior end of larva with noticeable lobes and spiracles
- 4 instars

Pupae

- useful for diagnostic purposes
- general laval appearance but wing casing and antennae visible

Crane Flies diagnosis

Damage

- Pupal cases noticeable after adult emergence
  - “leatherjackets”
- Roots – similar to grub damage
  - Yellowing and dead spots
- Crowns, stems and shoots
  - turf thinning and
- Damage often heavy in late winter-early spring
  - overwintered mature lavae
- Observed in aerification holes scalping surrounding turf
  - Similar to cutworm damage

from Peck 2006

scouting and decision making

method	# individuals
Soil core sorting	15-50 larvae / ft^2 (1-5 per cup cutter

<u>Adults</u>

- *T. paludosa* – fall
- *T. oleracea* – spring or fall
- Adults good predictors of future larval distribution

<u>Larvae</u>

- *T. paludosa* – fall and early spring (same generation)
- *T. oleracea* – late winter/early spring (G1) or summer (G2)
- Low lying, chronically wet or poorly drained soils
- Soil cores and hand sorting for larvae

treatment options

target larvae

- Preventive
  - After peak emergence of adults
  - Fall – both species
  - chlorantraniliprole (Acelepryn)
  - imidacloprid (Merit)

- Curative
  - Spring – both species
  - Summer – *T. oleracea*
  - Imidacloprid (Merit)
  - chlorpyrifos
  - Carbaryl
  - Entomopathogenic nematodes
    - (*H. bacteriophora, S. feltiae*)

T. paludosa

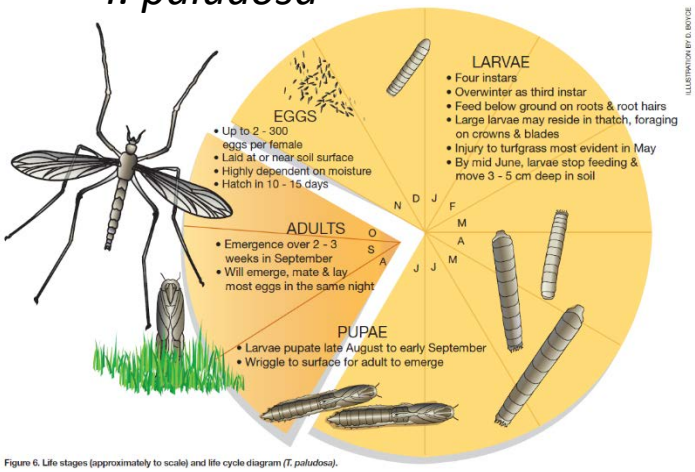
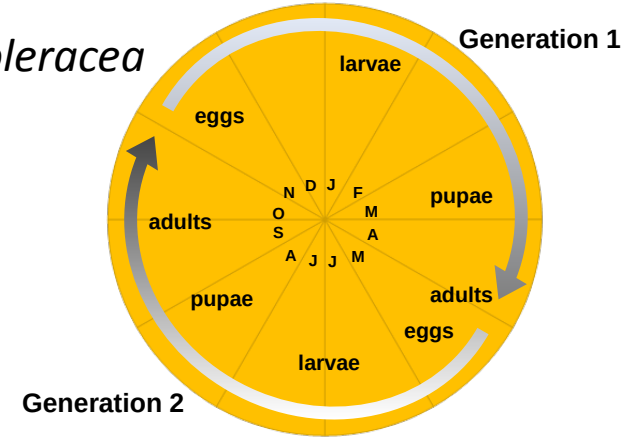


Figure 6. Life stages (approximately to scale) and life cycle diagram (*T. paludosa*).

T. oleracea



ants

Natural history

- Widespread in NY
- Multiple spp. widespread in NY

Lasius neoniger

- Common on all turf types

  - mounding typically only a problem on short mown playing surfaces (e.g. golf putting greens)
- Prefers sandy, well-drained soils
- Mating flights occur in summer
  - Mated queens seek overwintering sites
  - establish new colonies the following spring
- New mounding activity begins in spring and lasts through summer

Lasius neoniger diagnosis

Adults

- 1/10 – 1/3 inch long
- Tan-brown
- Constricted waste
- Petiole (joint between anterior and posterior body segments)
  - one segmented
  - plate-like
- Abdomen lacks a sting, instead has ring of setae
  - acidopore

Lasius neoniger diagnosis

Damage

- Mounding at soil surface
  - smothers turf
- Subterranean chambers cause rapid soil drainage and poor root moisture
- Affect playing surfaces
- Dull or chip mower blades
- Tend root aphids which are minor turf pests

scouting and decision making

Scouting

- Scout for mounds around mid-summer
  - Re-check problem areas the following spring for overwintered ants as they become active again
- Search for mounds outside of immediately affected area
  - Fairways and roughs
    - Mounds on greens are often part of a larger colony system established in adjacent native turf

scouting and decision making cont…

Treat or not?

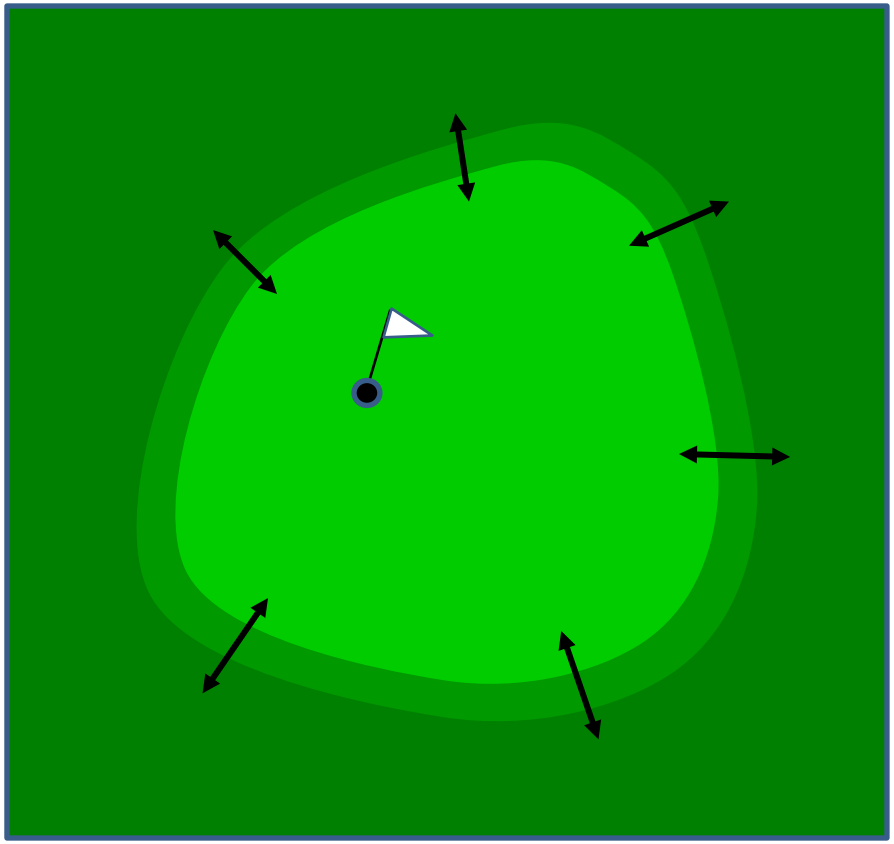
- Consider severity
- Also consider role of ants in egg predation
- If treatment required, treat early in season when mounding first apparent
  - Colony smaller and queen weaker than later in season
  - Treat as close to main nest areas as possible to increase chance of killing queen

When treatment is warranted

Suppress only!!!

- Spring pyrethroid knock-down in perimeters
  - Bifenthrin (Talstar)

- Follow-up with granular bait
  - Abamectin (Advance)
  - Hydramethylnon (Extinguish)



Lepidoptera

Moths and caterpillars

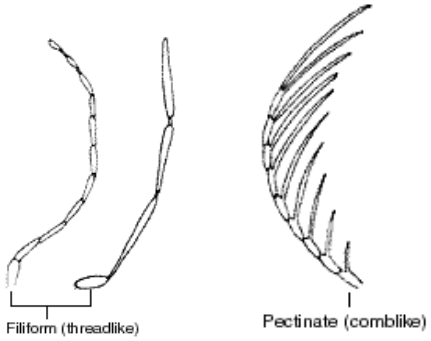
Black cutworm

Agrotis ipsilon

Natural history

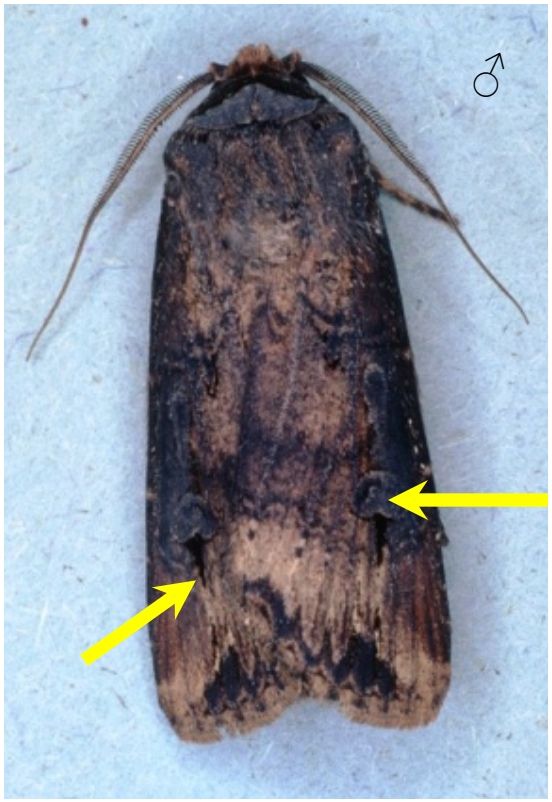
- Common to many turf environments, but typically only a pest in short mown turf (golf greens and tees)
- Does not overwinter in NY or anywhere with soil freezing
  - Adults arrive in spring with storm fronts
- 2-3 gen/yr in NY
- Adults feed on flowers (nocturnal)
- Oviposit on grass blade tips
  - often on creeping bentgrass
- Mature larvae feed from protective burrows in turf/thatch/soil

Black cutworm diagnosis



Adults

- Dark gray-brown
  - mottled black-brown
- Antennae pectinate ♂ or filiform ♀
- Wings
  - Black-lined spot
  - Dagger-shaped marking



Black cutworm diagnosis

Larvae

- 6 instars
  - 1-3 feed at surface
  - 4-6 feed from burrows
  - pupate in soil
- Mature – 1-2 inches
- Gray-green to black
- Often pale middorsal line
- Spiracles black
  - Paired – 1 lg, 1 sm
- 15x pebbly appearance

Black cutworm diagnosis

Damage

- Pocks around burrow hole of later instars
  - Resembles ball marks
- Often found in aerification holes

scouting and decision making

- Spring sampling for adults
  - Black light or pheromone traps
  - BUT…poor predictor of infestation
- Monitor for larvae 1-2 wks after adults spotted/reported
- Monitor young larvae to increase chance of effective treatment
- Soap flush on greens (1oz/2gal)

scouting and decision making cont…

Treat or not?

- Thresholds
- Cultural steps before insecticide treatment?
  - Mowing
    - Mowing removes up to 80% of eggs
    - Early morning mowing can kill mature larvae (become nocturnal)
  - Kentucky bluegrass buffers around greens
  - Integrating endophyte-infected tall fescue into turf

Soap flush	# individuals
greens/tees	3-4 larvae
fairways	5++ larvae

Sod Webworm

Natural history

- Complex of many native spp.
  - 100+ NA species
  - Common turf infesting genera
    - *Parapediasia, Pediasia, Crambus*
- 1-3 gen/yr
  - Varies by spp.
  - Overwinter as larvae or pupae in hybernacula in soil/thatch
- Common in lawns, roughs, fairways
- Broad feeding range
  - Includes many non turf crops

Sod Webworm diagnosis

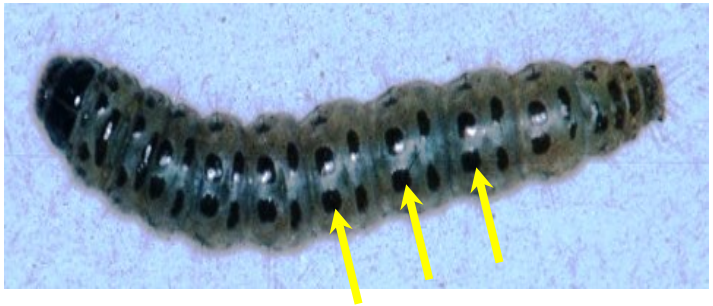
Adults

- "snout moth"
  - Palps extend snout-like
- ~0.5-0.75 inches long
- Wings held along abdomen to give slender appearance
- White-tan-gray
  - Gold-silver fringed upon close examination
- Alight when disturbed at dusk by walking/mowing and return quickly to turf

Sod Webworm diagnosis

Larvae

- 6-10 instars
  - 7-8 most common
- green-gray-brown
- dark spots across body
- 0.3-1 inch long
- create silk-lined burrow in thatch
  - “hybernacula”
  - evidence of frass in tunnels



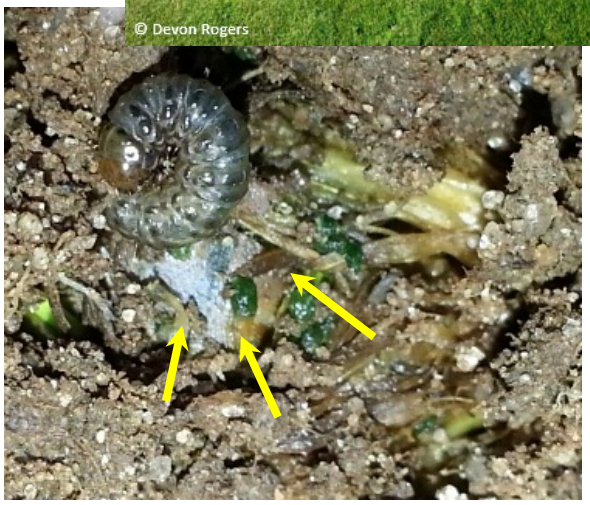
Sod Webworm diagnosis

Damage

- Low clipped grass turning yellow/brown
- Browning depressions
  - Often confused with drought stress

scouting and decision making

- High numbers of adults don't predict future larval density/damage
  - Adult monitoring to determine larval scouting time
- Scouting for larvae
  - Soap flush
  - Search thatch within damaged areas for larval frass
  - Foraging birds

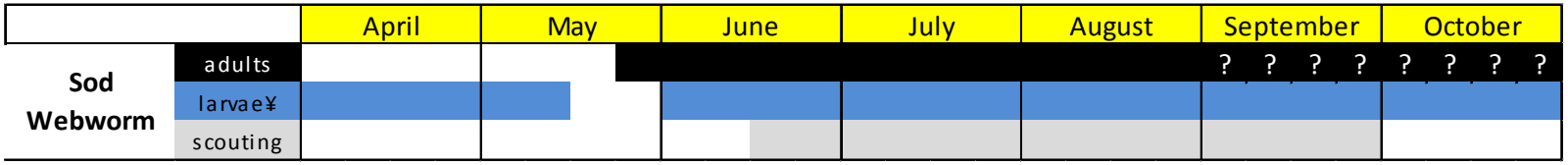


scouting and decision making cont…

Treat or not?

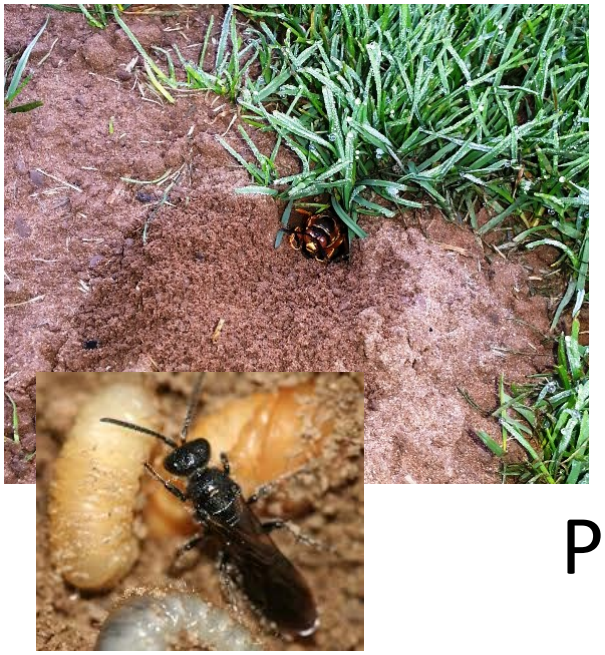
- Scout for larvae 2 wks after adults seen flying
- Overall turf health
- Threshold level?
  - ~12 / ft^2 but higher numbers have been found without signs of damage
  - *Take overall turf health into account when SWW encountered*

Soap flush	# individuals
Larvae (soap flush)	12 per ft^2
Larvae (soil cores)	1 per core



Specimen Group 4

Moths and caterpillars



Beneficials

Predators/Parasitoids

Decomposers

Fungivores

Pollinators

beneficials

big eyed bug

ground beetle

hister beetle

rove beetle

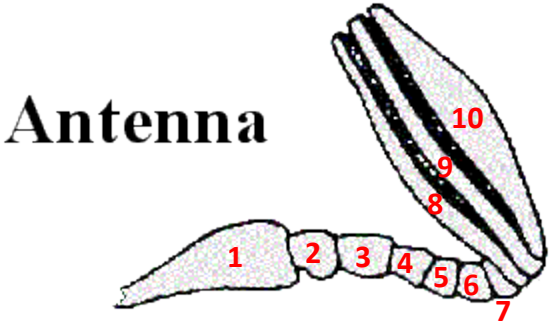
Specimen Group 5

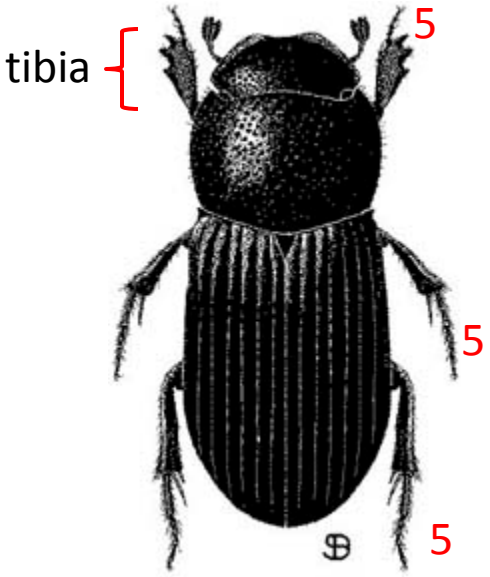
Predators

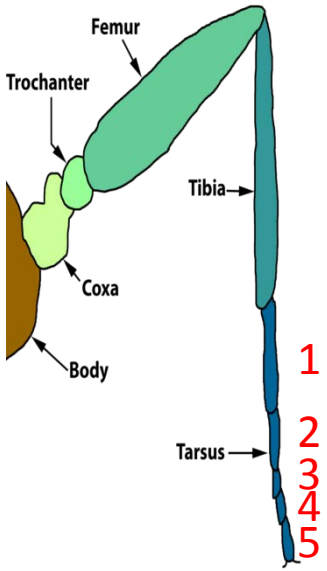
Diagnosis
-adults-

General Scarab Features

- front tibia widened with outer edge toothed
- antennae 9-10 segmented
- last 3-7 antennal segments flattened to form a club
- tarsal formula 5-5-5 (or 0-5-5)







annual | bi/triennial | bivoltine

EXOTIC

European chafer

- Length –0.5-0.55”
- Translucent elytra
- Lt. yellow band of hairs behind pronotum

Japanese beetle

- Length –0.3-0.4”
- Metallic green and copper
- Alternating black/white

Oriental beetle

- Length – 0.4”
- Pronotum green or brown
- Banding on elytra

Asiatic garden beetle

- Length – 0.3-0.45”
- Spine rows on ventral abdom. segments

NATIVE

Black turfgrass ataenius

- Length –0.2”
- Brwn-black
- Broad clypeus

Northern masked chafer

- Length -0.4-0.46”
- dark brwn head/ light brwn clypeus

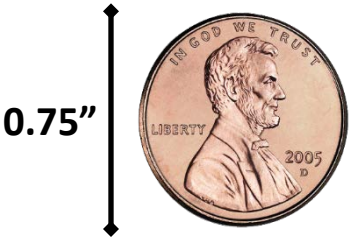
May/June beetle

- Length – 0.4-1”
- Varying size and color
- Toothed tarsal claw

Green June beetle

- Length – ¾ - 1”
- Metallic green-tan
- Light lateral color band

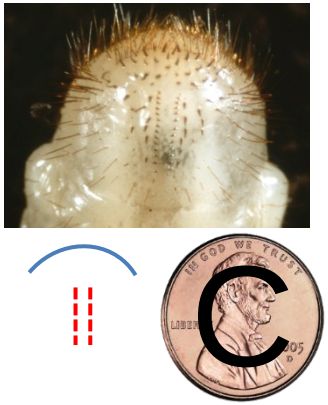
white grubs



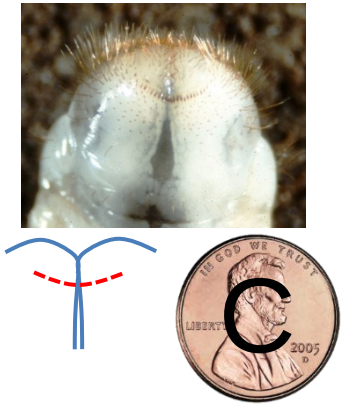
European chafer

Japanese beetle

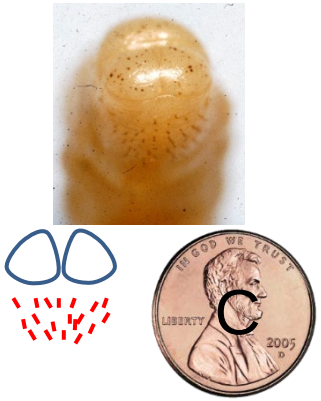
Oriental beetle



Asiatic garden beetle

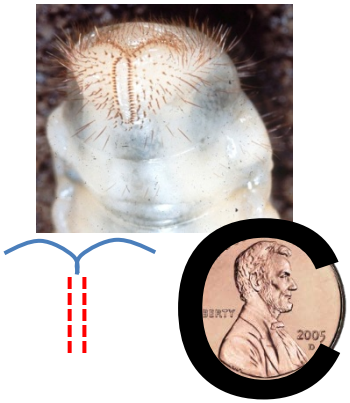


Black turfgrass ataenius



Northern masked chafer

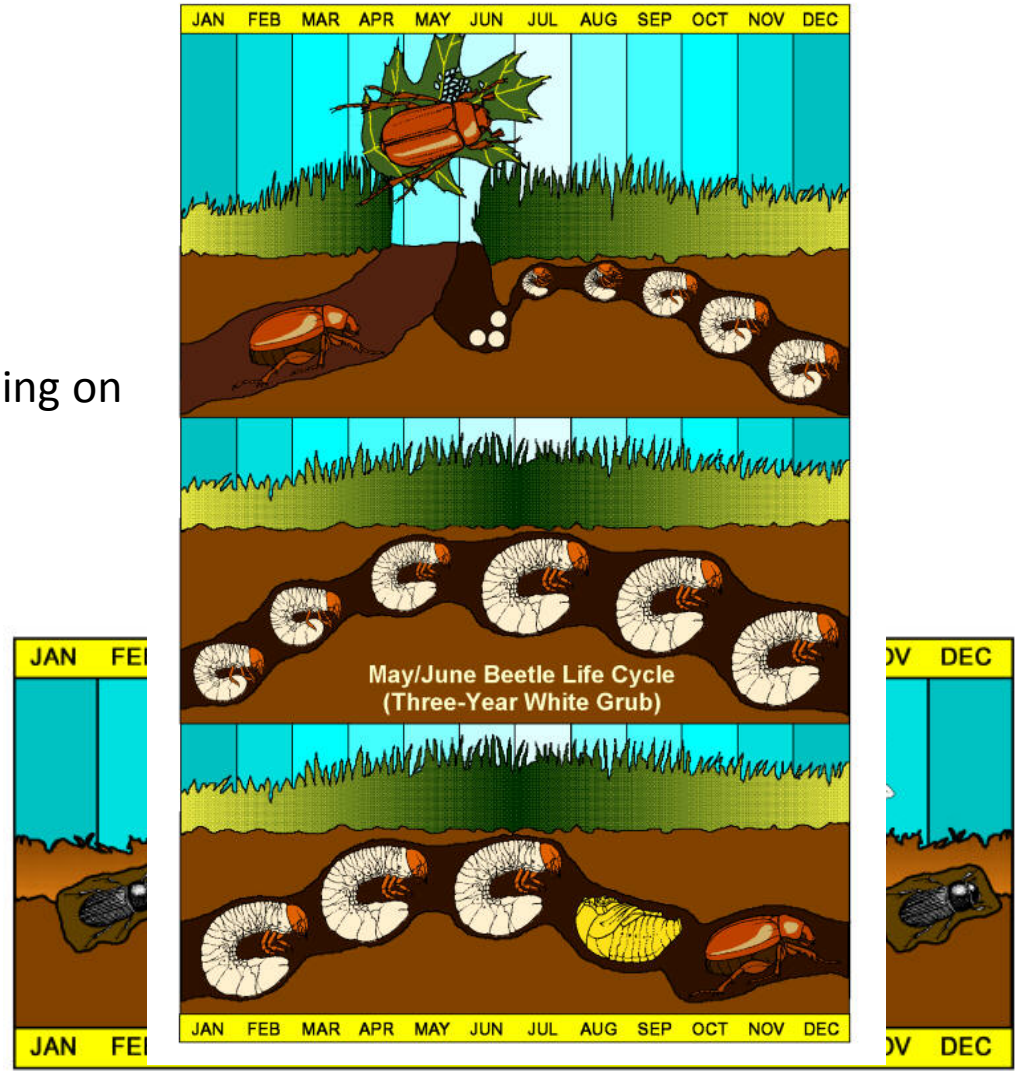
May/June beetle



Green June beetle

-non-annual white grubs-

- >1 generation/yr
  - multivoltine
  - black turfgrass ataenius
- <1 generation/yr
  - May/June beetle
  - some annual white grubs depending on climate
    - e.g. Japanese beetle in N. NY



White grubs
diagnosis

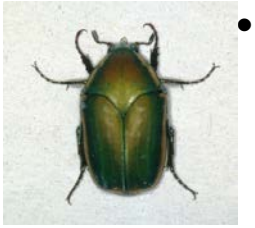
Damage (species-specific)

- Black turfgrass ataenius – short mown turf

- Asiatic garden beetle – typically feed deeper than other grubs, thus less damaging to turf

- European chafer – wide depth range, also feed on fibrous roots of surround plants, feed later in season than others

- May-June beetle – also feeds on fibrous roots of surrounding plants in addition to turf, most damaging in second year



- Green June beetle – larvae feed on organic matter and damage turf roots via tunneling

scouting

- Adults
  - May - June
  - pitfall traps
  - direct observation in turf/on pavement adjacent to turf
- Larvae
  - mid-late summer for larvae
  - heat extraction, salt float, or hand sorting from soil cores
  - larvae and frass in soil around base of plant