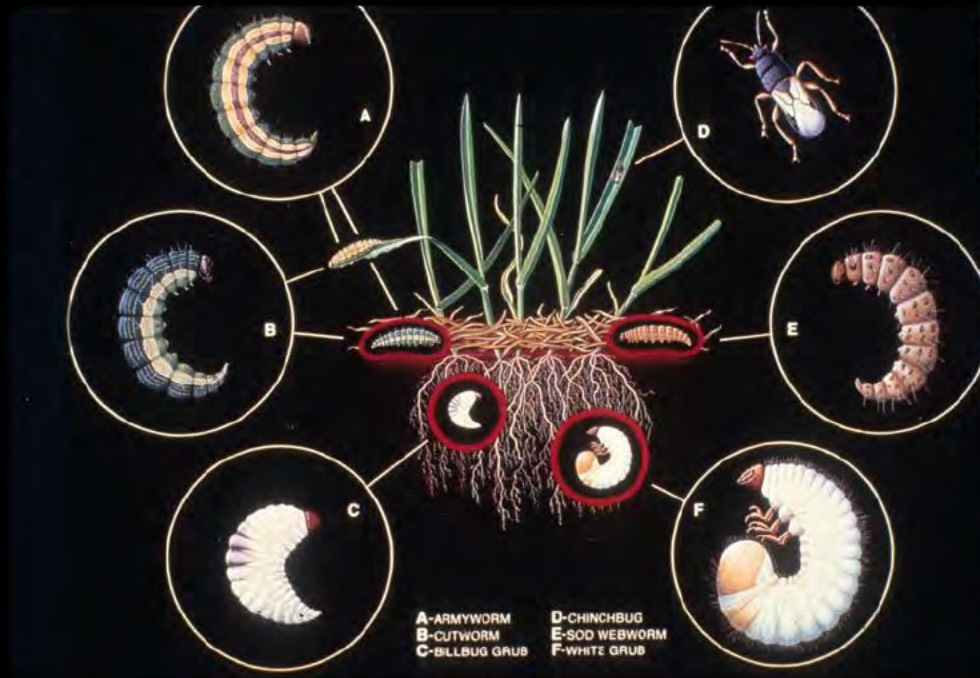


A Review of Turfgrass Insects and Mites



Whitney Cranshaw
Colorado State University



What kind of “bugs” are present in a lawn?

- **Plant feeders**
 - **Root/subterranean feeders**
 - **Crown feeders**
 - **Surface/foilage feeders**
- **Predators/Parasitoids**
- **Macrodecomposers**

Insects that Feed in the Root System of Turfgrass



Billbug Larvae



White Grubs



Cranberry Girdler, Some Cutworms

Primary root feeding group of turfgrass – white grubs



White Grubs

(Coleoptera: Scarabaeidae)

Larvae of scarab beetles – chafers, May/June beetles, dung beetles, etc.



Primary Scarab Beetles of Colorado Turfgrass



May/June Beetles



Japanese Beetle



Masked Chafers

Scarab Beetles of Montana Turfgrass



May/June Beetles



Japanese Beetle

In turfgrass, the adult beetles burrow shallowly into moist soil and lay eggs.

Eggs are laid singly or in small groups.



Physical Characteristics of a White Grub



- Distinctive, dark head
- Distinct legs on thorax (3 pairs)
 - No legs on abdomen
- Body normally assumes C-shape

May/June beetle

Japanese beetle

European chafer



Identifying White Grubs



**Check the Rastral
Pattern!**

White Grub Rastral Patterns

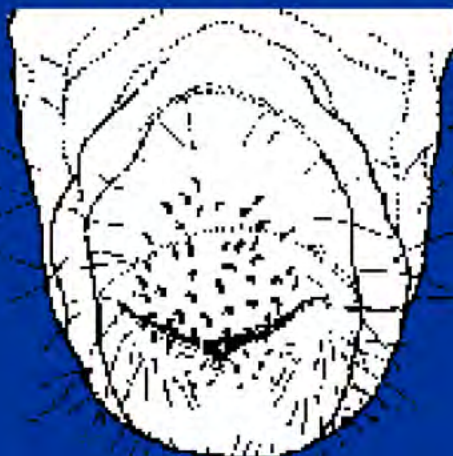
May/June Beetle



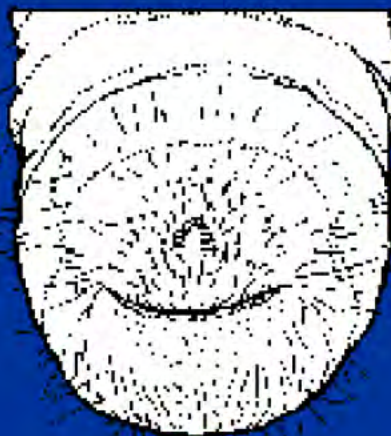
A rastral pattern is an arrangement of short, stout hairs located above the anal slit at the tip of the abdomen, when the grub is positioned as shown here.



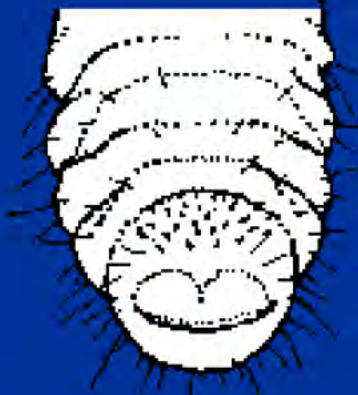
Masked Chafer



Japanese Beetle

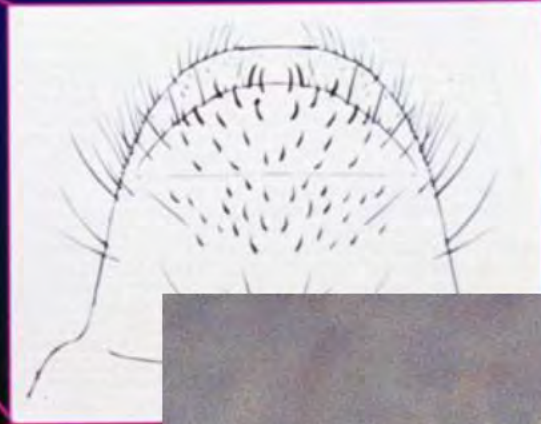


Black Turfgrass
Ataenius



Identification of White Grubs

Masked Chafer
raster pattern



Turfgrass damaging white grubs feed on the roots of their host plants







**As grubs get older,
more root pruning
occurs**





Peak larval damage can be expected to occur in August, early September



**Skunk digging
damage associated
with white grub
infestations**







May/June Beetles

Phyllophaga species



UGA2121083

Widespread group of native scarab beetles associated with grasslands – and sometimes turfgrass



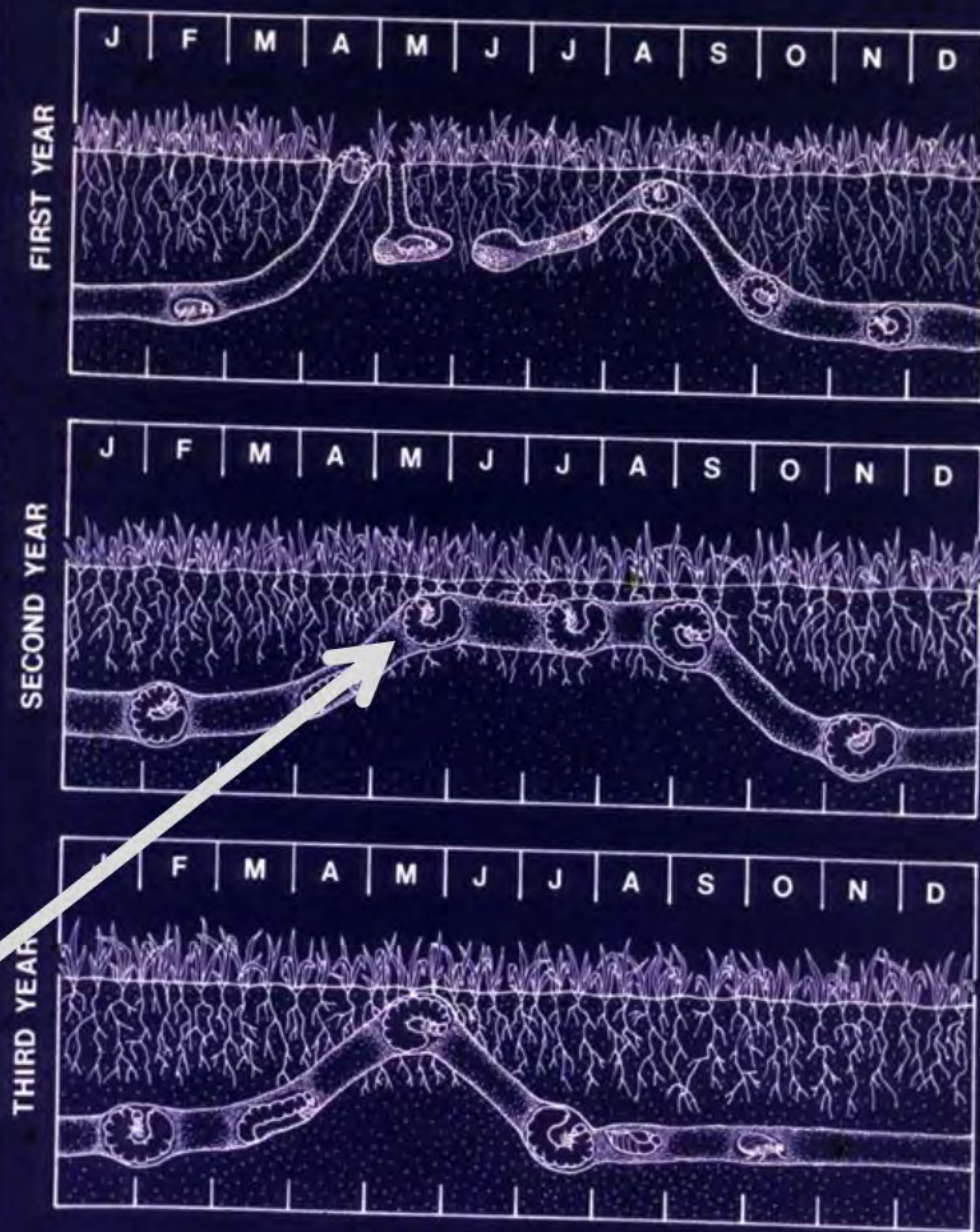
Adults fly at night. They may feed a bit on plant foliage, but injuries are rarely observed and never significant to plants.





Life cycles of
May/June beetles
typically require **three
years** to complete in
the northern US

Peak damage *in year
after peak adult flight*



Phyllophaga spp.



**Mixed sized
larvae present,
due to extended
life cycle**



**Key rastral
pattern feature**



Largest white grub in soil – **Tenlined June beetle (and relatives (*Polyphylla* species)**

Some regional *Polyphylla*
species. Males on top row,
females on bottom row



**Larvae may feed on roots
of trees and shrubs**



Japanese Beetle

Popillia japonica





**Japanese beetle
adults chew on
leaves and flowers
of many plants**



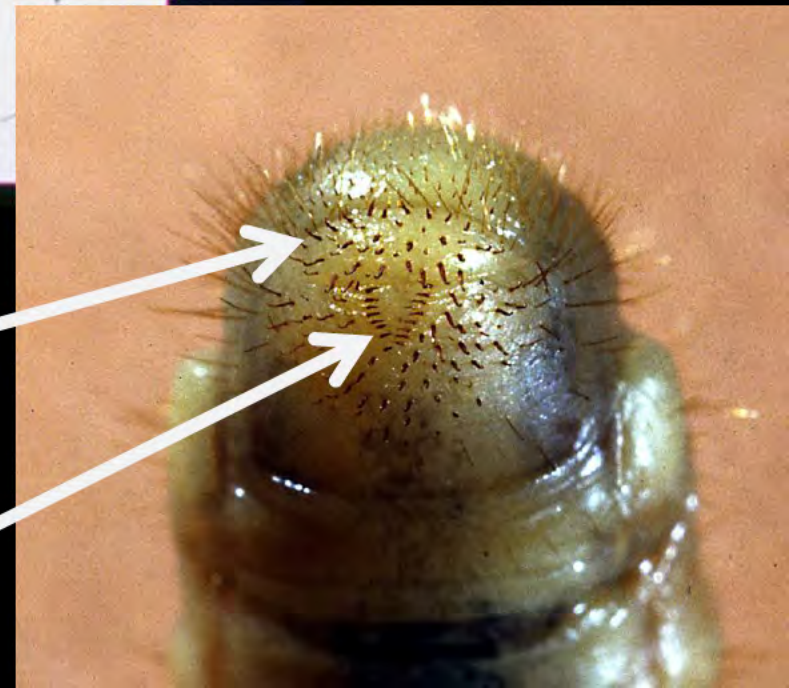
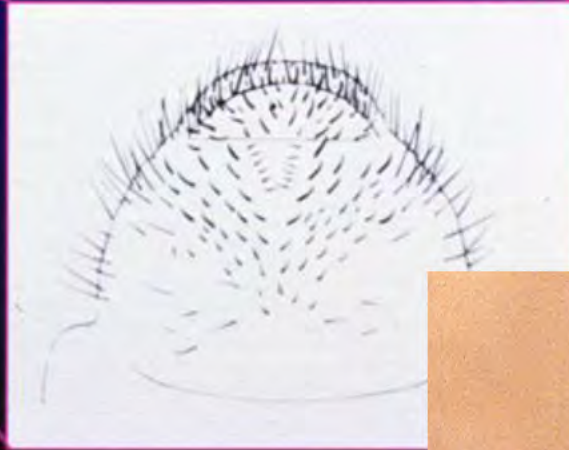
**Japanese beetle
larvae (grubs) –
Among most
damaging turfgrass
insects in the US**



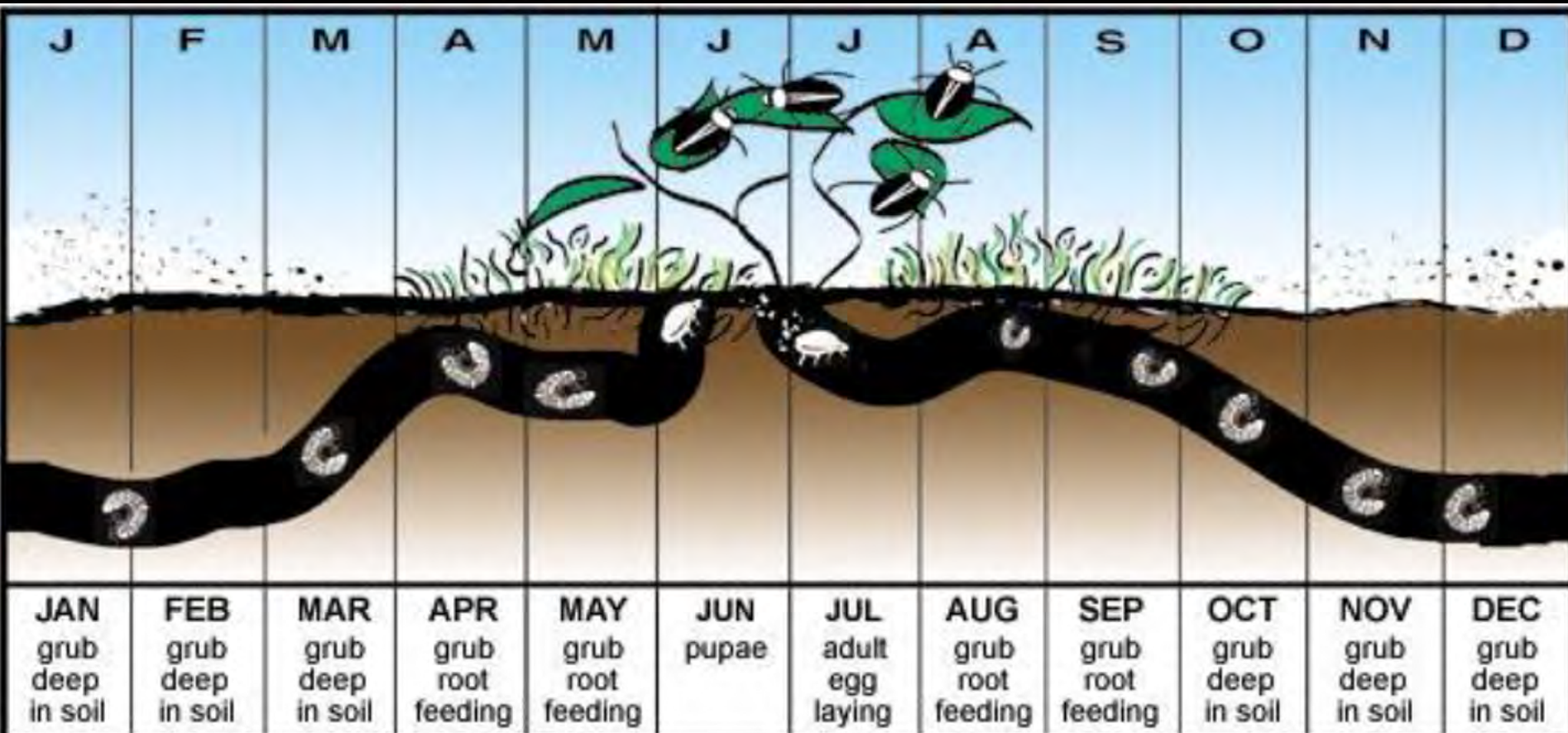
Identification of White Grubs



Japanese Beetle
raster pattern



Generalized Life History Sequence of Japanese Beetle





**Adults burrow into the ground to lay eggs.
Eggs are only laid in soil that is suitably
moist.**

Japanese Beetle Life Stages



egg

1st

2nd

3rd

pupa

adult

instar larva

Early stages of Japanese beetle grubs are highly sensitive to soil drying

Japanese Beetle Life Stages



egg

1st

2nd

3rd

pupa

adult

instar larva

Control of White Grubs in Lawns

- **Cultural practices**
- **Insecticides**
- **Biological controls**

Primary Neonicotinoid Insecticides Used on Turfgrass

- **Imidacloprid** (Merit, Criterion, Zenith, many generics)
- **Clothianidin** (Arena)
- **Thiamethoxam** (Flagship, Meridian)

Combination products

Aloft – clothianidin + bifenthrin

Allectus – imidacloprid + bifenthrin

Neonicotinoids and Pollinators – *Should we be concerned about their use on turfgrass?*





Lawns can be an important resource site from many pollinating insects!



Pollinator assemblages on dandelions and white clover in urban and suburban lawns

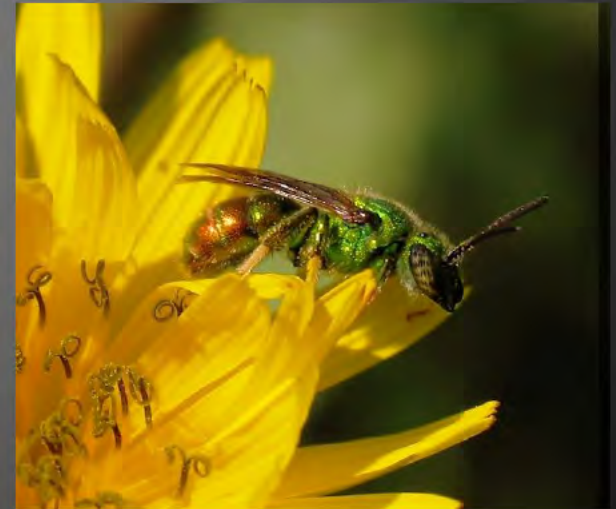
Jonathan L. Larson · Adam J. Kesheimer ·
Daniel A. Potter

Received: 30 January 2014 / Accepted: 30 August 2014
© Springer International Publishing Switzerland 2014

Abstract Flowering weeds, though often deemed undesirable in turfgrass lawns, provide food resources for declining pollinator populations in urbanized landscapes. We sampled bees and other pollinators directly from flowering common dandelion (*Taraxacum officinale*) and white clover (*Trifolium repens*) in lawns of similar char-

percentage of hardscape in surrounding areas. Fostering public awareness of the diversity of bees and other pollinators that visit flowering lawn weeds might help nurture a sociocultural shift toward more pollinator-friendly lawn care practices.

>50 total species collected





**A key risk to
pollinators when
using
insecticides on
turfgrass**

**Application to
flowering
weeds**





**Mowing before application >greatly<
decreases hazard to pollinators!**

White Grub Larval Treatments

- Imidacloprid (Merit, Zenith, Criterion, etc.)
- Clothianidin (Arena)
- **Chlorantraniliprole (Acelepryn, Scott's Grub-Ex)**
- Trichlorfon (Dylox, Proxol)
- *Heterorhabditis* spp. parasitic nematodes
- *Bacillus thuringiensis* var. *galleriae* (grubGONE!)

Acelepryn

- **New class of insecticides – anthrinilic diamides**
 - Based on natural product (*Ryania*)
- **Activity against most chewing insects**
 - **White grubs, billbugs** (Coleoptera)
 - **Sod webworms, cutworms** (Lepidoptera)

Acelepryn

- **Very low toxicity to vertebrates**
 - **LD50 greater than 5000 mg/kg**
 - **Class 4 – No Caution label**
 - **Protective equipment**
 - **Long sleeved shirt, long pants**
 - **Shoes with socks**
- **Very low hazard to non-target organisms (bees, birds)**

White Grub Larval Treatments

- Imidacloprid (Merit, Zenith, Criterion, etc.)
- Clothianidin (Arena)
- Chlorantraniliprole (Acelepryn, Scott's Grub-Ex)
- Trichlorfon (Dylox, Proxol)
- ***Heterorhabditis* spp. parasitic nematodes**
- ***Bacillus thuringiensis* var. *galleriae* (grubGONE!)**

Insect Parasitic Nematodes (“Beneficial Nematodes”, “Predator Nematodes”)



Photograph courtesy of Peggy Greb



Nematodes enter insects through natural openings



***Heterorhabditis* spp.
nematodes can
penetrate directly
through the body wall**



= *Heterorhabditis* spp.

= *Neoplectana* spp.

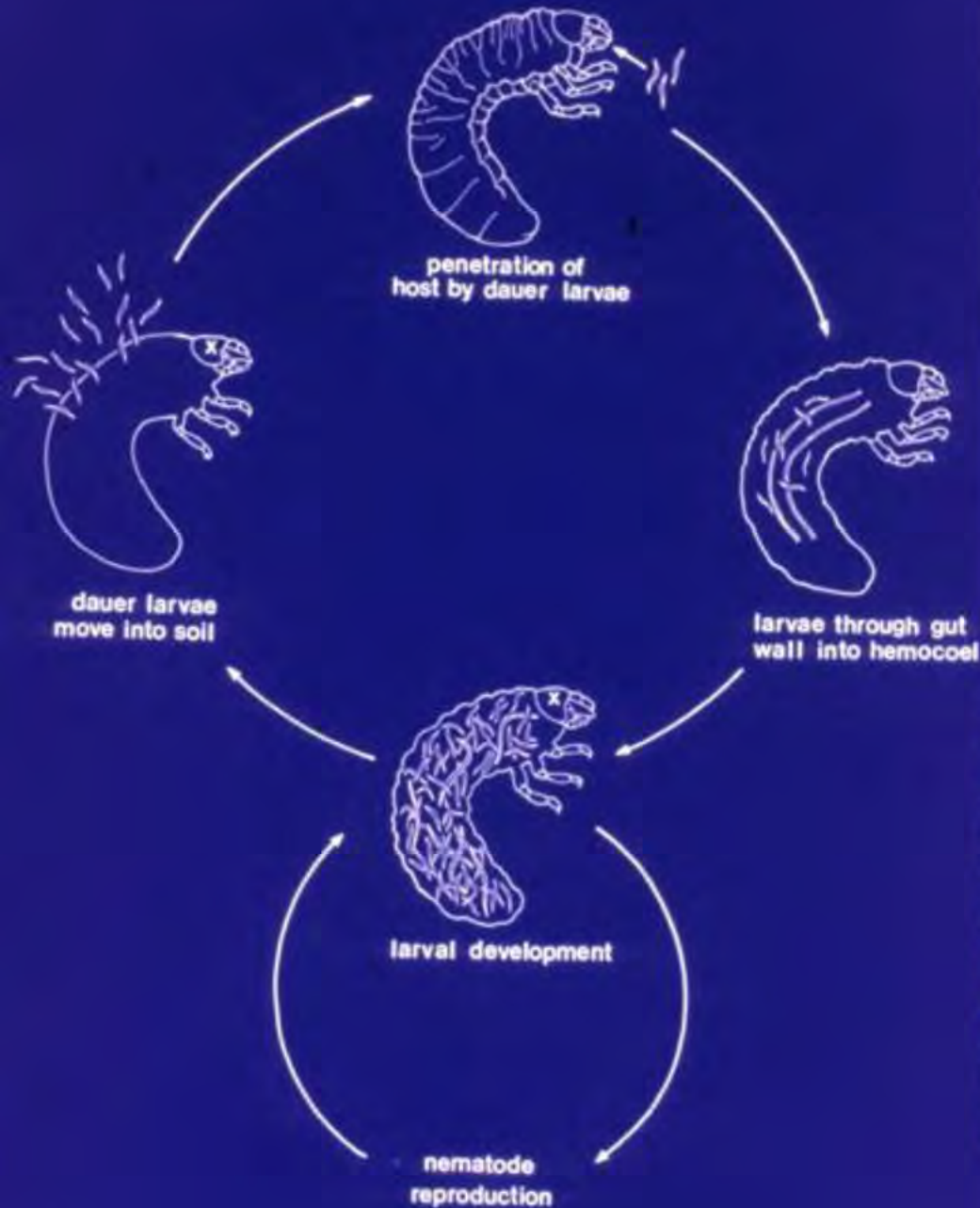
Insect Parasitic Nematodes Can Control Many Turf Insects

White grubs

Billbugs

Cutworms and sod webworms

Mole crickets



Grubs turn a reddish color when killed by *Heterorhabditis* nematodes



A common – *but non-damaging* - white grub/scarab beetle

Bumble Flower Beetle
Euphoria inda



Larvae feed on decaying organic matter – particularly animal manures

A common – *but non-damaging* - white grub/scarab beetle



Bumble Flower Beetle *Euphoria inda*



Adults feed on fermenting materials, including plant ooze



Billbugs

Sphenophorous spp.

The grass feeding weevils



**Rocky Mountain
billbug**



**Bluegrass
billbug**

Billbug Life Stages



Billbug Egg Inserted into Grass Stem



**Young Billbug
Larvae Develop
within Plant Stems**



Billbug damaged turfgrass breaks easily at crown (“tug test”)



Diagnostic: Sawdust frass characteristic of billbug larval feeding



Older Billbug Larvae are Root Feeders





**Billbug larva –
no legs**

**White grub –
Legs present**



Diagnosis of Billbug Damage

- **Turfgrass has appearance of drought stress**
 - Turf may die in patches
- **When pulled ('tug test') grass breaks at crown**
 - Plant base should show chewing injury
- **Granular sawdust-like frass present around feeding site**



Bluegrass billbug

Rocky Mountain billbug



Billbug Controls

- **Use of resistant cultivars**
- **Adult control**
 - Targeted at periods when adults are present on surface
- **Larval control**
 - Must concentrate in crown and upper root zone

Caterpillar Pests of Turfgrass

**Sod Webworms and
Cutworms**

Caterpillar Pests of Turfgrass

Sod Webworms and Cutworms



Common Cutworms in Turfgrass

- **Bronzed cutworm**
- **Army cutworm**
- **Winter cutworm**
- **Black cutworm**
- **Armyworm**
- **Fall armyworm**



**Bronzed
Cutworm**





Army Cutworm

**Common Turfgrass
Cutworm**

**- and the Notorious
“Miller Moth”**





Another new insect to watch out for:

Noctua pronuba

Large yellow
underwing

Winter cutworm





An odd behavior

This caterpillar may be seen actively moving about on warm days throughout winter!



Sod Webworms –

Caterpillars that feed on grasses, usually within a silken structure





**Typical sod
webworm larvae**





Most sod webworm larvae live within a burrow (often lined with silk) in the thatch



The larvae feed on grass blades, which they clip. Feeding occurs at night.



Life Stages of a Sod Webworm

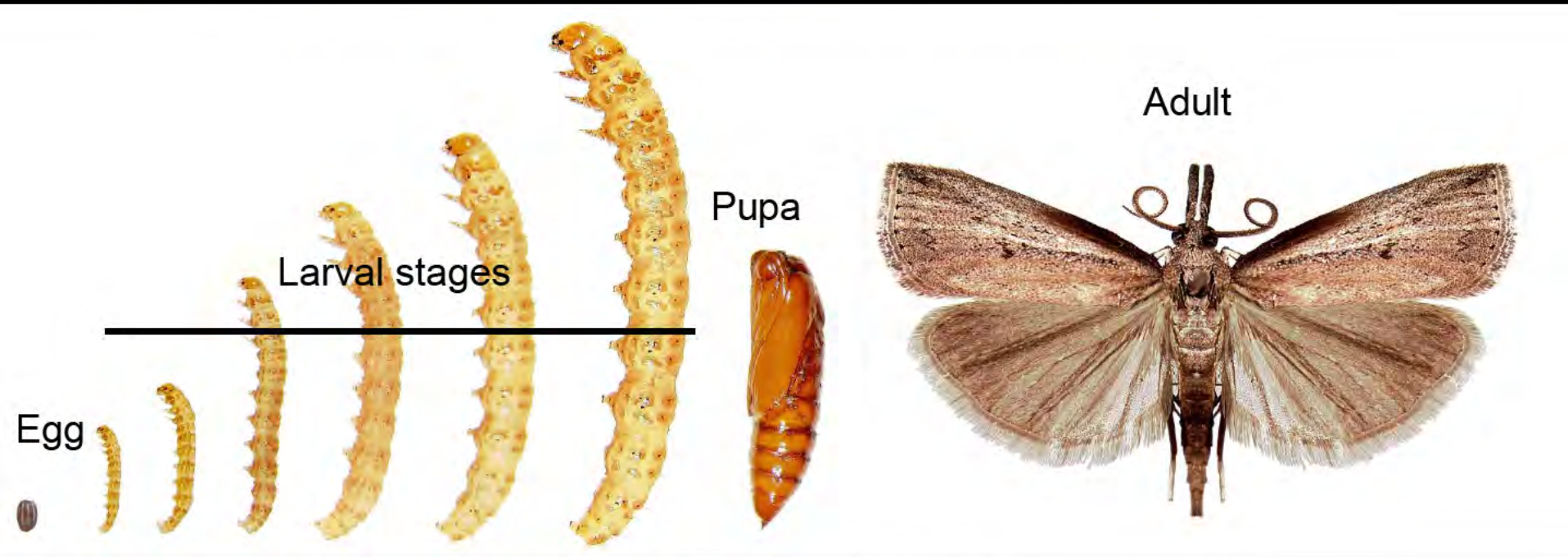


Image courtesy of David Shetlar, Ohio State University

Sod Webworm Adults



Key Aspects of Sod Webworm Biology

- **Most species overwinter as larvae**
- **Most species have two generations**
 - **Peak lawn damage done by overwintered larvae**
 - **Second generation feeds in July, August**
- **Adults rest on grass or adjacent vegetation during the day**
 - **Adults fly at dusk, night**
 - **Eggs are dropped onto turfgrass during flight**



Typical Peak Damage:
Early spring
(overwintered larvae)

Some species -
July/August (2nd
generation)



Blackbirds Feeding on Sod Webworms and Cutworms



Holes made by birds seeking sod webworm (or cutworm) caterpillars



Piles of fecal pellets collect where sod webworms (and cutworms) rest



Diagnosis of Sod Webworm Damage

- **Turfgrass slow to green in spring**
- **Blackbirds feed on the lawn**
- **Close inspection may show piles of pelleted frass, composed of grass particles**

**A subterranean sod webworm –
the cranberry girdler**





Larvae develop below ground, feeding on roots



Adults lay eggs at dusk, during mid-late summer



Cranberry Girdler

**“The Subterranean
Sod Webworm”**

**Feeds in crown area
and upper root zone**

**Peak injury September
and early October**



Treatment Options for Cranberry Girdler

- Trichlorfon (Dylox)
- Chlorantraniliprole (Acelepryn)
- Insect predator nematodes (if soils warm enough)
 - *Steinernema feltiae*

Insects that Feed in the Root System of Turfgrass



White grubs



Billbug larvae



Cranberry girdler

Turfgrass Mites of Colorado

- **Clover Mite**
- **Banks Grass Mite**
- **Brown Wheat Mite**
- **Winter Grain Mite**
- **Buffalograss Mite (eriophyid mite)**

Clover Mites





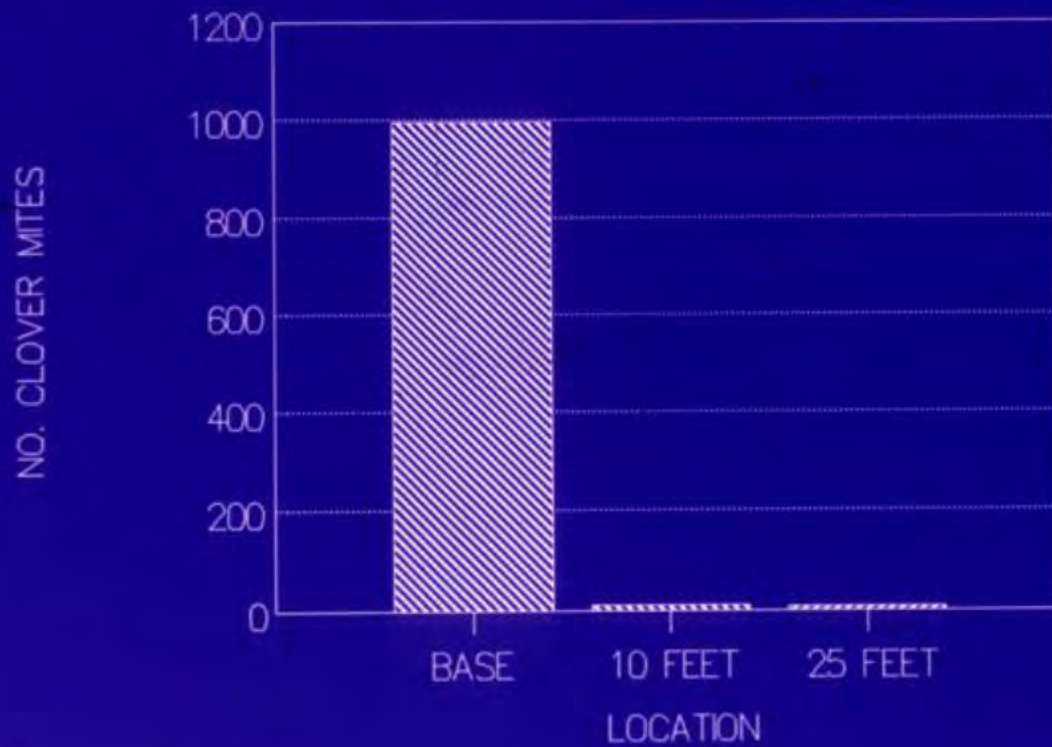
**Clover Mite Activity
is Concentrated
around Buildings,
Trees, Shrubs and
Other Aboveground
Objects**





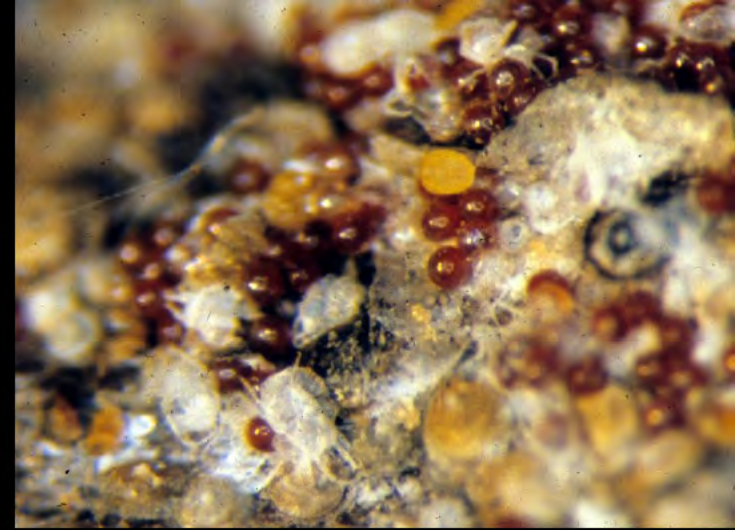
CLOVER MITE POPULATIONS

SITE 2

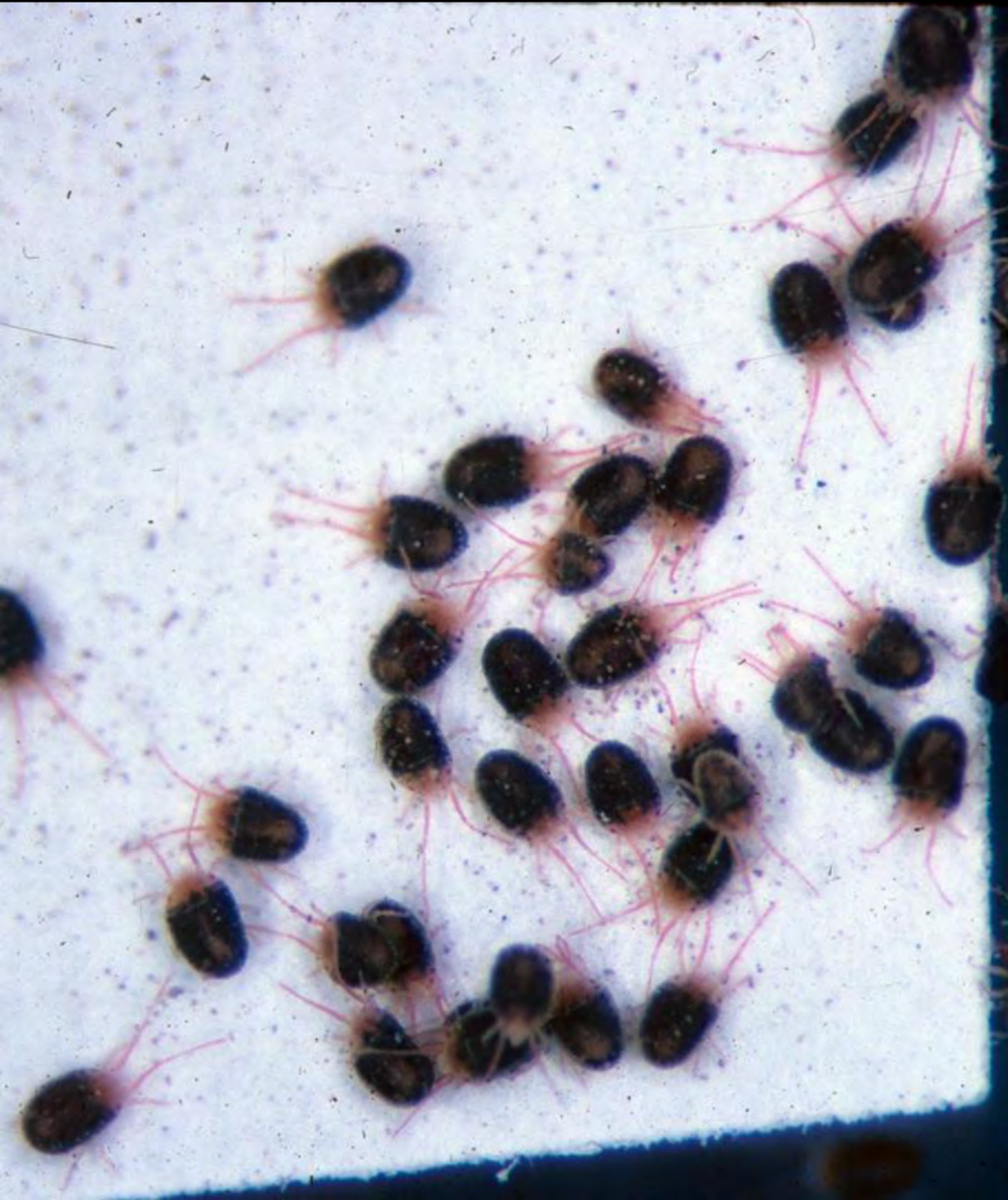


Clover mite activity – Late February through Late April

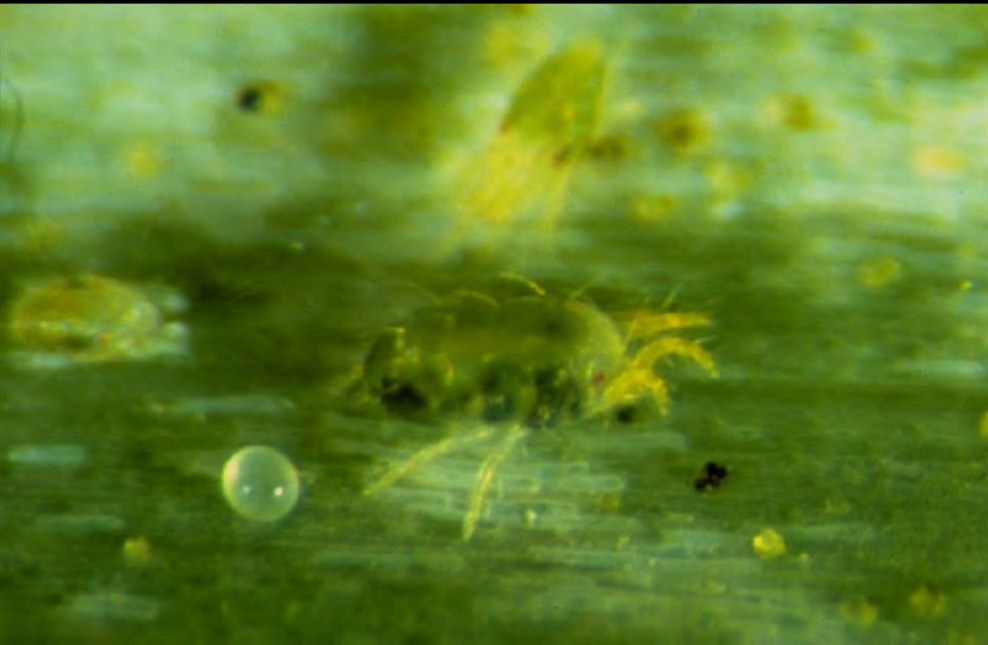




**Clover mites
often
accidentally
enter buildings
during warm
days in spring**



Banks Grass Mites



Injury by Banks Grass Mites





Turf – Water = Mites
in spring









Water critical areas if they need it



Mite Control Products

(Post Organophosphate Period)

- **Talstar**
- **Scimitar**
- **Extra Irrigation**

Miscellaneous Sucking Insects Associated with Turfgrass

- **Chinch bugs**
- **Aphids**
 - **Surface feeders**
 - **Root aphids**
- **Mealybugs and scales**
- **Leafhoppers**
- **Thrips**

Greenbug aphid



Often the most
common aphid in
lawns in early spring



Orange-yellow appearance of greenbug affected bluegrass



Lady beetles and flower flies cruising turfgrass usually indicate greenbug infestations in spring

Lady beetle larva feeding on greenbug aphids



Flower fly larva feeding on greenbug aphids



Leafhoppers



Extension Fact Sheet



Leafhoppers on Lawns

Fact Sheet 5.608


Predators of Turfgrass Insects

- Ground beetles
- Rove beetles
- Big-eyed bugs
- Lady beetles
- Ants



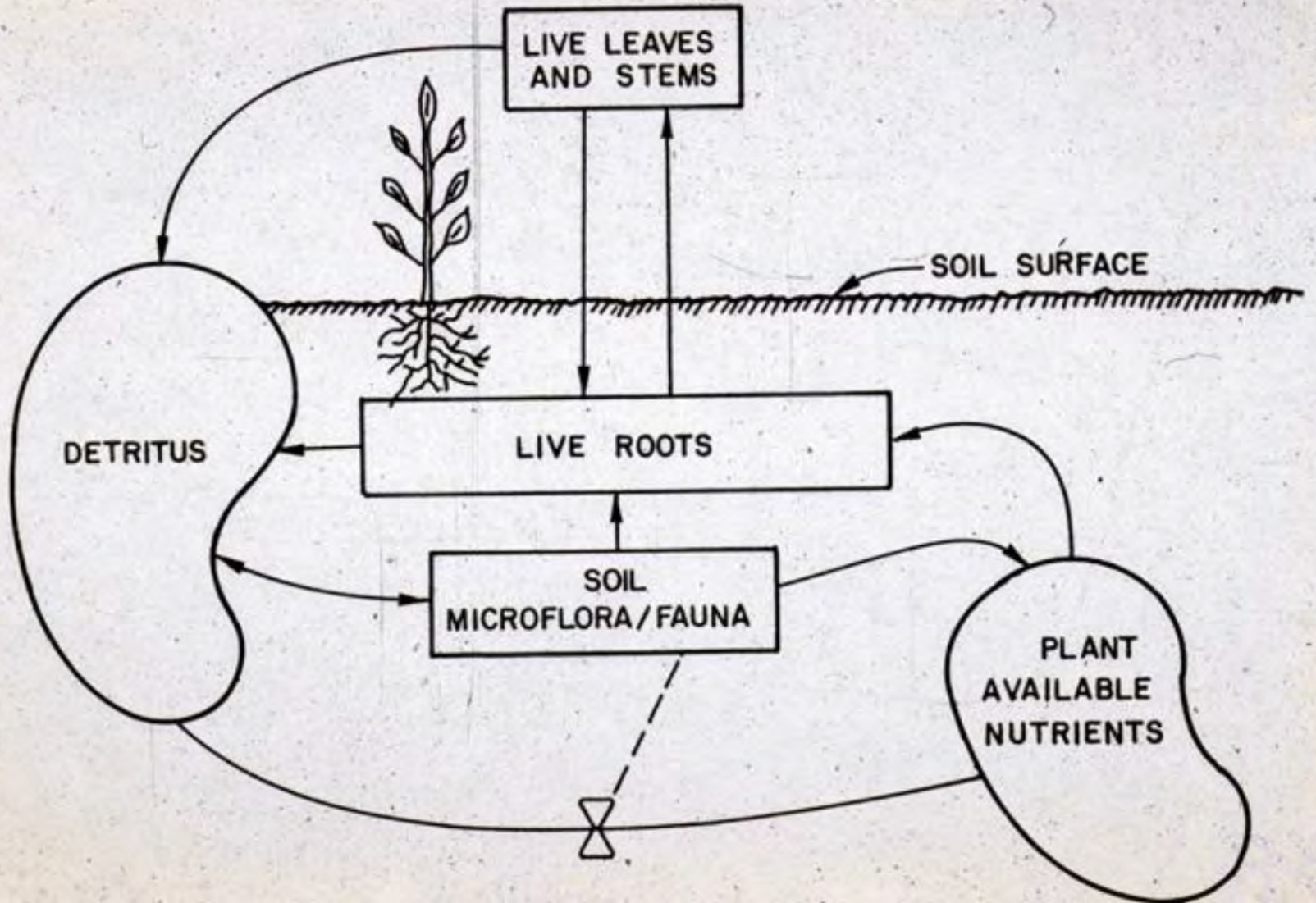
Macro-Decomposers Associated with the Turfgrass Ecosystem

- **Springtails**
- **Oribatid mites**
- **Fungus gnats, March flies**
- **Millipedes**
- **Sowbugs/Pillbugs**
- **Earthworms**



Thatch: the layer of undecayed plant material comprised of old roots, stems, and leaves

Nutrient Cycling



Macro-Decomposers Associated with the Turfgrass Ecosystem

- **Springtails**
- **Oribatid mites**
- **Fungus gnats, March flies**
- **Millipedes**
- **Sowbugs/Pillbugs**
- **Earthworms**

Montana Earthworms

- There are no earthworms native to Montana
- Fourteen (14) species of earthworms have been found in the state – most all are European imports
- Many areas of the state likely still have no earthworms



A screenshot of the Montana Field Guide website. The page is titled "Earthworms" and features a search bar and a "Sort by Common Name" dropdown. The taxonomic classification is shown as: Kingdom - Animals - Annelida, Phylum - Segmented Worms - Annelida, Class - Earthworms, tube worms, leeches - Clitellata, Order - Earthworms / Tube worms - Haplobranchia, and Family - Earthworms - Lumbricidae. A list of species is displayed, each with a title, scientific name, and a note that it is a non-native species. The species listed are: Eisenia foetida, Eisenia tetraedra, Bimastos beddardi, Aporectodea longa, and Aporectodea tuberculata. Each entry includes a small image of the worm and a link to "View Images".



Essentially all earthworms found in yards and gardens in the RM West are of European origin



ENDOGEIC

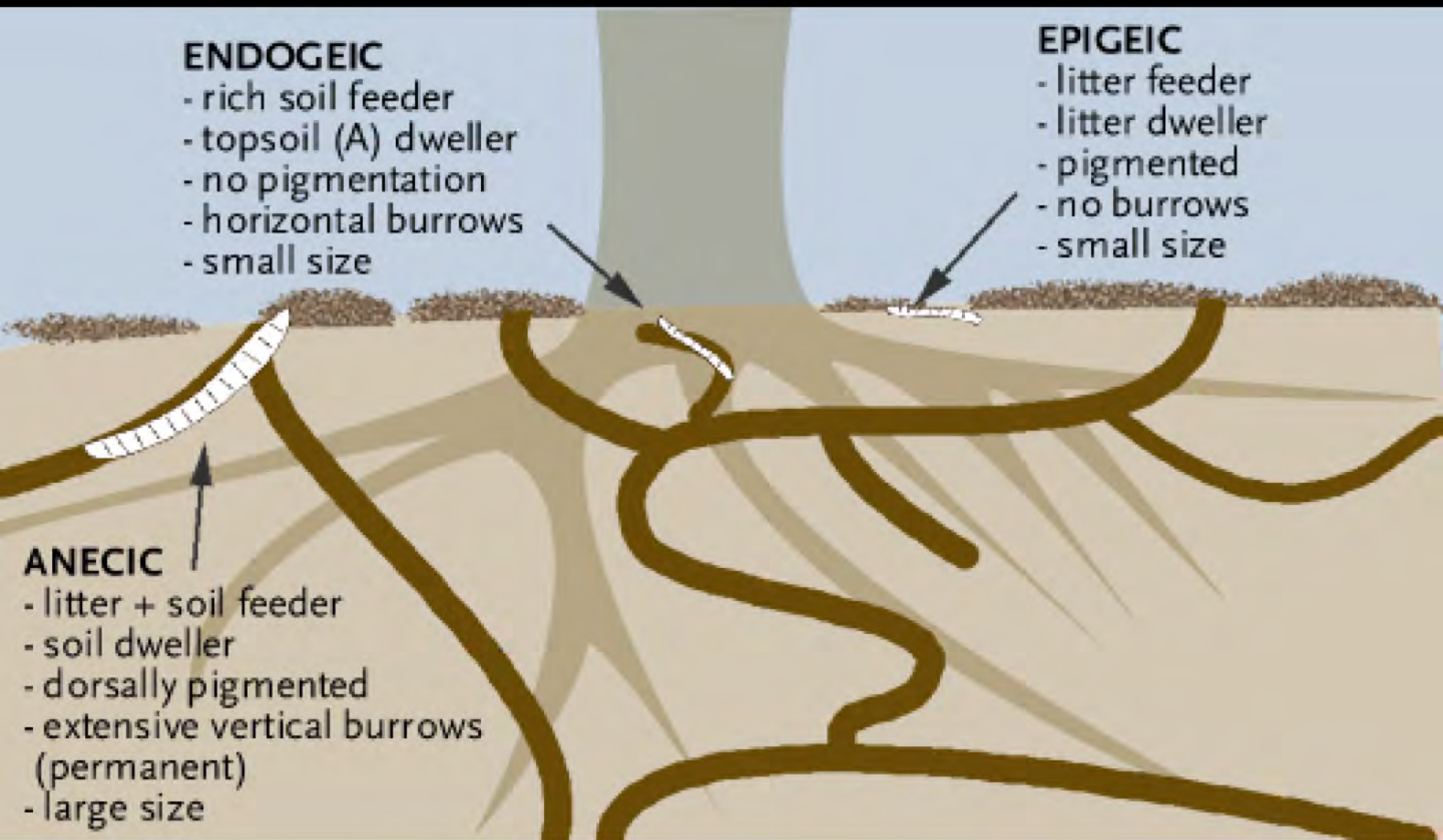
- rich soil feeder
- topsoil (A) dweller
- no pigmentation
- horizontal burrows
- small size

EPIGEIC

- litter feeder
- litter dweller
- pigmented
- no burrows
- small size

ANECIC

- litter + soil feeder
- soil dweller
- dorsally pigmented
- extensive vertical burrows (permanent)
- large size





**Earthworm castings
on surface**



Nightcrawler

Lumbricus terrestris





**The nightcrawler
is an *anecic*
species**



**Nightcrawlers
forage and mate
on the surface –
at night**



**The nightcrawler
makes large
piles of surface
castings at the
burrow entrance**



The potential importance of earthworms to turfgrass



The potential importance of earthworms to turfgrass



The potential importance of earthworms to turfgrass



Oil-seed camellia for reducing worms in problem areas?



Also known as tea-oil camellia, *Camellia oleifera*. Used as a cooking oil source in China for over 2000 years.



The waste material after oil extraction is “tea seed meal”.

It can be used as a low nitrogen, organic fertilizer.

Tea seed meal contains saponins, which can be lethal to earthworms.



CastAway DG is a tea seed meal product presently sold in the US as a fertilizer to turfgrass.

There are no label claims that is kills earthworms – but this is essentially the sole end use for this product.

CastAway DG

1-0-0

- Fertilizer and soil amendment
- Nutrients derived from tea seed meal after camellia oil extraction
- Patented dispersing granule (DG) technology

Guaranteed Analysis

Total Nitrogen (N)..... 1.00%
1.00% Water Insoluble Nitrogen

Derived from tea seed meal.

F002091

Florida Applications:

We recommend that you follow the Florida Green Industries BMP's at: <http://www.flrules.org/Gateway/reference.asp?No=Ref-04706>
We recommend that you follow the Florida Golf Course BMP's at: <http://www.flrules.org/Gateway/reference.asp?No=Ref-04702>

Information regarding the contents and levels of metals in this product is available on the internet at <https://www.aapfco.org/metals.html>

Product Information

Castaway is a homogenous dispersing granule (DG) tea seed meal fertilizer made from the residue of camellia seeds after oil extraction. It can be used in many turfgrass situations and across all turfgrass species.

Directions for Use

Provides a nitrogen source. Apply to dry turfgrass at 3.0 to 6.0 lbs product per 1000 sq ft (lbs prod/M). Water in with approximately 0.10-0.20" of water within 12-24 hours after application to avoid mower pick-up. Irrigation or rainfall will disperse the product into the turf canopy and soil for improved product efficacy and decreased mower pick-up. Reapply every 2 weeks (LOW rate) or 3-4 weeks (HIGH rate). Reapplication interval can be



WARNING
May cause mild eye irritation
May cause respiratory irritation

PRECAUTIONARY STATEMENTS

- Wear protective gloves and clothing
- Remove contaminated clothing and wash before reuse
- Avoid breathing dusts
- Use only outdoors or in well ventilated area
- Call poison control or seek medical attention if you feel unwell
- Wash thoroughly after handling
- Do not eat, drink or smoke when using this product

FIRST AID AND MEASURES

- IF INHALED:** Move to fresh air and keep comfortable, seek medical attention if unwell.
- IF ON SKIN:** Wash affected areas with soap and water. Seek medical attention if irritation persists. Wash contaminated clothing before re-use.
- IF IN THE EYES:** Immediately flush with water for 15-20 minutes, remove contact lenses if present and easy to do – continue rinsing. Seek medical attention if irritation persists.
- IF SWALLOWED:** Rinse mouth. DO NOT INDUCE VOMITING unless directed by a medical professional. Seek medical attention if unwell.

IMPORTANT: READ BEFORE USE:

Read the entire Directions for Use and the Warranty Disclaimer and Limitation of Liability before using this product. If terms are not acceptable, return the unopened product container at once. By using this product, user or Buyer accepts the following Warranty Disclaimer and Limitation of Liability:

WARRANTY DISCLAIMER and LIMITATION of LIABILITY:

Manufacturer warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions. Manufacturer makes NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. To the extent consistent with applicable law, it is Manufacturer's intent to LIMIT ANY LIABILITY FOR SPECIAL, CONSEQUENTIAL OR INCIDENTAL ECONOMIC DAMAGES to refund of purchase price or replacement of product, at Buyer's choice. To the extent consistent with applicable law, Manufacturer DISCLAIMS ANY LIABILITY FOR COMPENSATORY OR OTHER DAMAGES ARISING OUT OF ANY USE CONTRARY TO LABEL DIRECTIONS. Use contrary to label directions is not permitted.

LEGAL RIGHTS:

THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS; YOU MAY HAVE OTHER RIGHTS THAT VARY FROM STATE/JURISDICTION TO STATE/JURISDICTION.

Product of U.S.A.

Manufactured by:
The Andersons, Inc.
P. O. Box 119, Maumee, OH 43537
www.andersonsplantnutrient.com

Castaway is a trademark of The Andersons, Inc. The Andersons logo is a registered trademark of The Andersons, Inc.

Suggested Spreader Settings				
These suggested spreader settings are not intended to replace calibration. Please calibrate your spreader before applying product.				
40 lbs. treats 13,300 sq. ft. (0.31 acre) at the 131 lbs. product/acre - LOW RATE				
40 lbs. treats 6,600 sq. ft. (0.15 acre) at the 261 lbs. product/acre - HIGH RATE				
SPREADER	GROUND SPEED	WIDTH OF COVERAGE	SPREADER SETTINGS	
			LOW RATE 3.0 lbs. prod/M	HIGH RATE 6.0 lbs. prod/M
Andersons Model 2000 / AccuPro 2000				

Macro-Decomposers Associated with the Turfgrass Ecosystem

- **Springtails**
- **Oribatid mites**
- **Fungus gnats, March flies**
- **Millipedes**
- **Sowbugs/Pillbugs**
- **Earthworms**

Oribatid Mites



Brian Valentine

Springtails



Brian Valentine



Brian Valentine



Tom Murray



Brian Valentine

**Many springtails
have a “spring
tail”**



Tom Murray



Springtails

Fact Sheet 5.602

Millipedes, Sowbugs and Pillbugs



Sowbugs



Pillbugs



Millipedes

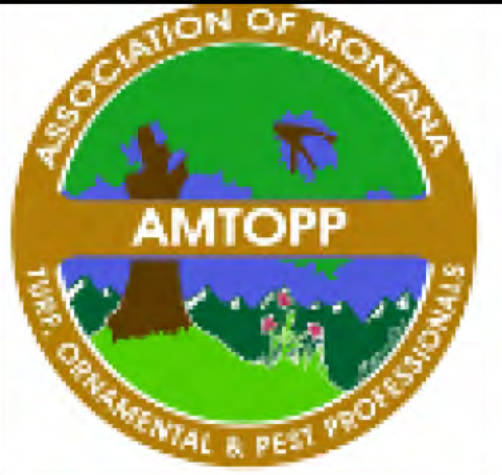


Estimated No. of Arthropods Per Acre of Pasture Soil (Salt 1943)

- **666,300,000** Mites
- **248,375,000** Springtails
- **71,850,000** Aphids and other sucking insects
- **55,500,000** Millipedes, centipedes, beetles, and miscellaneous arthropods

Estimated No. of Arthropods Under a Size 9 Converse Footprint

- **3,332** Mites
- **1,242** Springtails
- **359** Aphids and other sucking insects
- **411** Millipedes, centipedes, beetles,
and miscellaneous arthropods



Questions??

And, if you wish to contact me my email works best:

whitney.cranshaw@colostate.edu

PestTalk (pestserv-l) Listserver

- **Discussion group dedicated to problems on lawns, landscapes, gardens in Colorado and adjoining states**
 - **Heaviest discussion related to tree problems**
- **Now in its 28th year**
- **Approximately 225 participants**
- ***To join - drop me an email***