



Ecosystem Management

Review of Insects in Your Region

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Human Ag:
Interface with little aliens



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Human Ag:
Interface with little aliens



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TEXAS A&M
AGRI LIFE
EXTENSION

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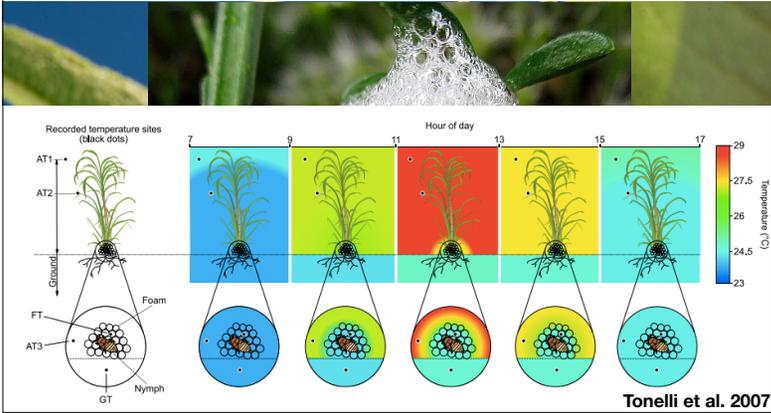
Human Ag:
Interface with little aliens



TEXAS A&M
AGRI LIFE
EXTENSION

4

Human Ag: Interface with little aliens



5

Human Ag: Interface with little aliens



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Insect Thermoregulation

Homeotherm: 98.6°F

Poikilotherm: Varies

Ambient Temperature: 120°F to -4°F

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Insects | A Word About “Cold Weather”

Freeze Tolerance

Woolly Bear
-20°C (-4 F) while frozen

Photo: Andrew Rothstein

Freeze Avoidance

Ips acuminatus
-34°C (29.2 F) using polyols (low weight anti-freezes)

Photo: Maja Jurc, University of Ljubljana, bugwood.org

UCA2103050

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Metamorphosis: (<Greek) a change in form

- *No metamorphosis* in two groups: springtails and silverfish
- *Gradual * metamorphosis*: grasshoppers, termites, thrips, dragonflies
- *Complete metamorphosis*: beetles, butterflies and moths, flies, bees and wasps, ants, fleas

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Gradual metamorphosis

- Three life stages: egg, nymph, adult
- Immatures called “nymphs” share a resemblance to the adult
- Wing-pads develop externally

Photo © Van Waters & Rogers / Univar

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Gradual metamorphosis



Egg



Nymph



Adult

Photos © Van Waters & Rogers / Univar

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Complete metamorphosis

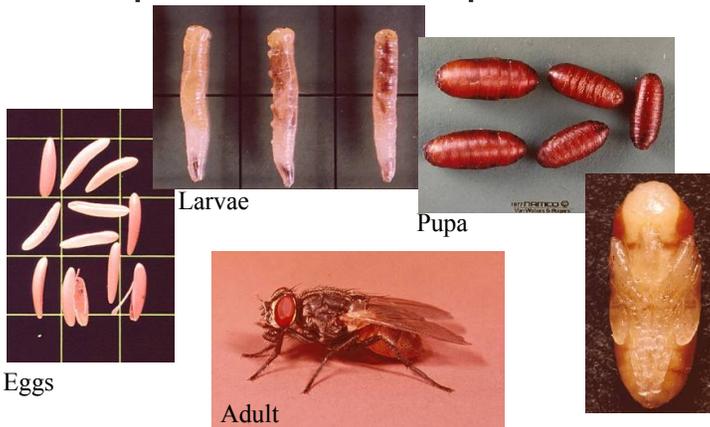
- Most advanced form of development
- Four life stages: egg, larva, pupa, adult
- Immature form called "larva"
- Wings develop internally in larvae



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Complete metamorphosis



Eggs

Larvae

Pupa

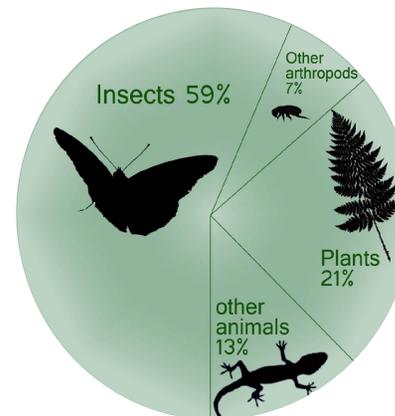
Adult

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The most diverse life form on the planet

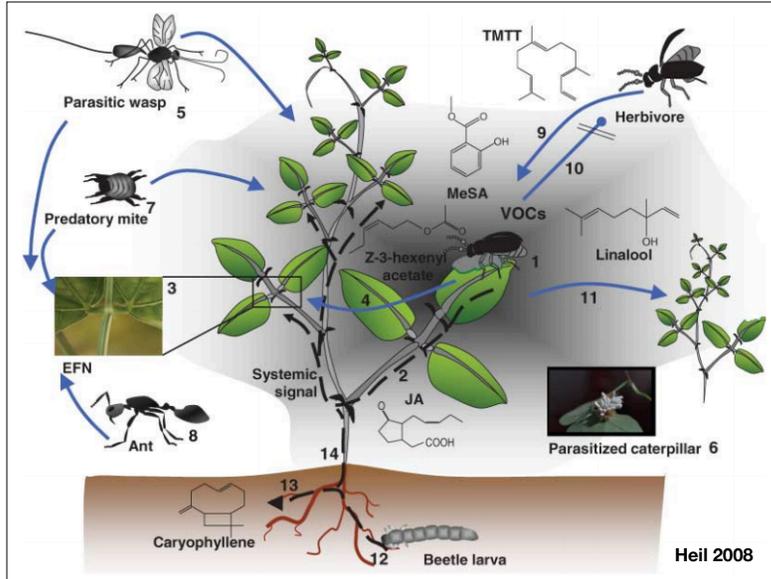


Recent estimates of species diversity

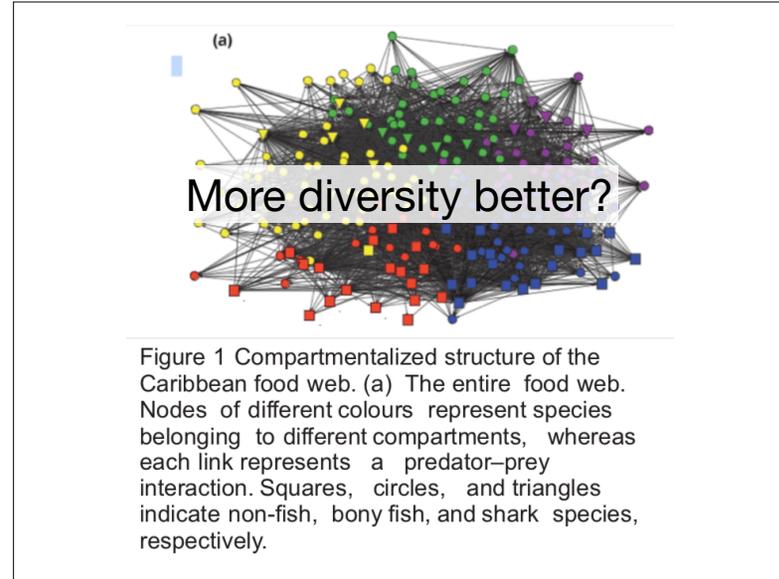
- 1.2 million species described
- Total estimated species count: 8.7 million (Eukaryotes)
 - 2.2 million marine
- 86% of existing species undescribed (96% of marine species) (Mora et al. 2011)

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Habitat Management to Suppress Pest Populations: Progress and Prospects

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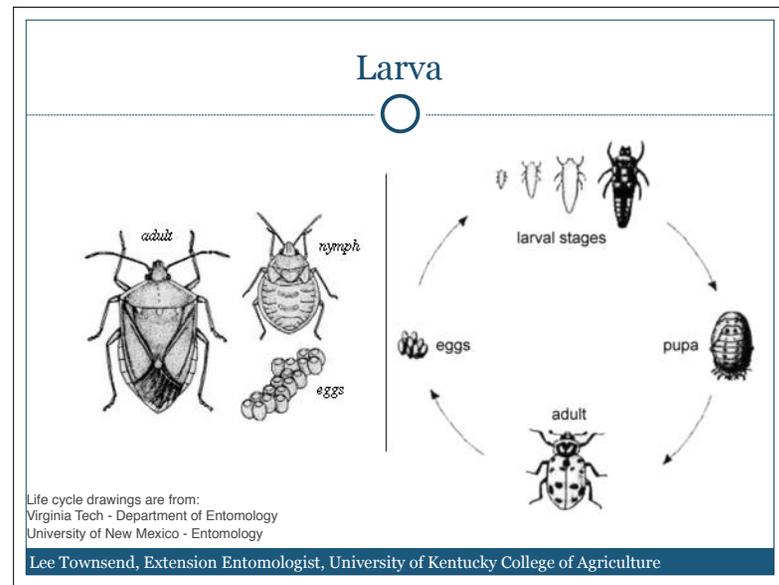
The *Annual Review of Entomology* is online at ento.annualreviews.org

Keywords

habitat manipulation, conservation biological control, ecological engineering, ecosystem services, natural enemy, agroecology

Abstract

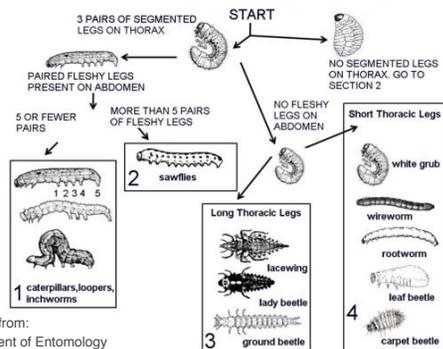
19



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Larva

PICTURE KEY TO INSECT LARVAL TYPES: SECTION 1

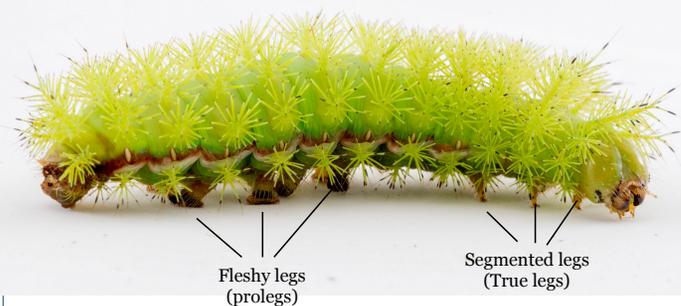


Life cycle drawings are from:
Virginia Tech - Department of Entomology
University of New Mexico - Entomology

Lee Townsend, Extension Entomologist, University of Kentucky College of Agriculture

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Larva

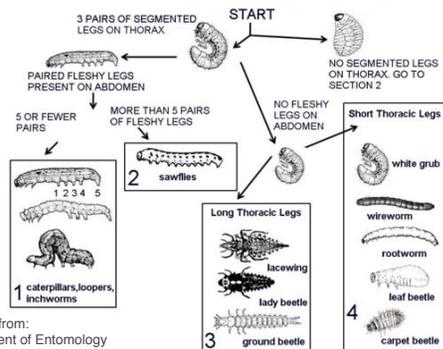


Io moth caterpillar, *Automeris io* (Erfan Vafaie, Texas A&M AgriLife Extension)

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Larva

PICTURE KEY TO INSECT LARVAL TYPES: SECTION 1



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Larva



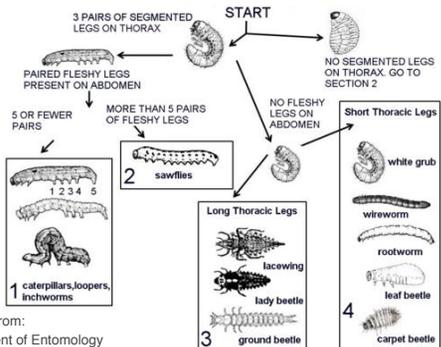
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Sawfly, Family: Symphyta

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Larva

PICTURE KEY TO INSECT LARVAL TYPES: SECTION 1



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Larva



Derek Parker, Flickr, Some rights reserved

Lady beetle larva, Family: Coccinellidae

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Larva



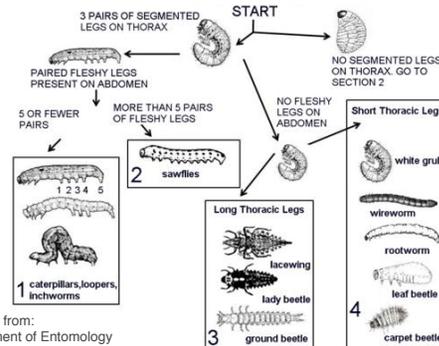
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Ground beetle larva, Family: Carabidae

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Larva

PICTURE KEY TO INSECT LARVAL TYPES: SECTION 1



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Larva



David Cappaert, Bugwood.org

White grubs, Family: Scarabaeidae

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Larva



Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org

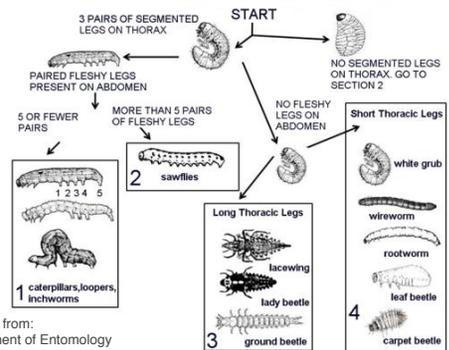
Tobacco wireworm, *Conoderus vespertinus*

30

Larva



PICTURE KEY TO INSECT LARVAL TYPES: SECTION 1



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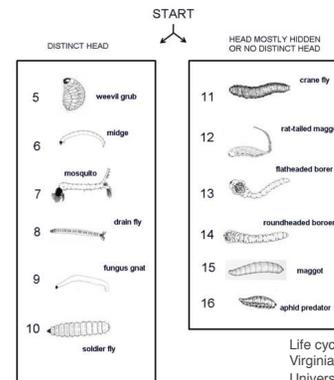
Lee Townsend, Extension Entomologist, University of Kentucky College of Agriculture

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Larva



PICTURE KEY TO LARVAL INSECT TYPES: SECTION 2



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Larva



David Cappaert, Bugwood.org

Darkwinged fungus gnat larva, *Bradysia* sp.

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Larva



Wayne N. Dixon, Florida Department of Agriculture and Consumer Services, Bugwood.org

Pitch-eating weevil, *Pachylobius picivorus*

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Larva



© CINHP / G. McCormack

Banana root borer, *Cosmopolites sordidus* (Germar)

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Larva

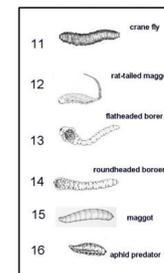
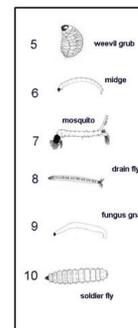


PICTURE KEY TO LARVAL INSECT TYPES: SECTION 2

START

DISTINCT HEAD

HEAD MOSTLY HIDDEN
OR NO DISTINCT HEAD



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Larva



John C. French Sr., Retired, Universities:Auburn, GA, Clemson and U of MO, Bugwood.org

House fly, *Musca domestica*

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Larva



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Crane fly larva, Family: Tipulidae

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30 Insect Orders

- Archaeognatha (bristletails)
 - Thysanura (silverfish)
 - Ephemeroptera (mayflies)
 - Odonata (dragonflies)
 - Plecoptera (stoneflies)
 - Isoptera (termites)
 - Blattodea (cockroaches)
 - Mantodea (mantids)
 - Grylloblattodea (ice crawlers)
 - Mantophasmatodea
 - Orthoptera (grasshoppers)
 - Phasmatodea (walking sticks)
 - Embiidina (webspinners)
 - Dermaptera (earwigs)
 - Zoraptera
 - Psocoptera (booklice)
 - Phthiraptera (lice)
 - Thysanoptera (thrips)
 - Hemiptera (bugs, aphids, etc)
- Holometabolous orders**
- Megaloptera, Raphidioptera, Neuroptera
 - Coleoptera (beetles)
 - Strepsiptera
 - Mecoptera (scorpionflies)
 - Siphonaptera (fleas)
 - Diptera (true flies)
 - Hymenoptera (bees, wasps, ants)
 - Tricoptera (caddisflies)
 - Lepidoptera (moths, butterflies)

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Leps	Coleo	Hemi	Hym	Dip	Orth	Neur	Thys	Trom	Tylen	Psoco
What are they?										
Hemipterans					Hymenoptera					
Diptera					Orthoptera					
Neuroptera					Thysanoptera					
Trombidiformes					Tylenchida					
Psocoptera										
Good bugs						Bad bugs				

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