

Intro to Insects

Erfan Vafaie
Extension Program Specialist, IPM
erfan.vafaie@ag.tamu.edu
(O) 903-834-6191
sixleggedaggie.com



Entomology

Plant Pathology

Weed Management

Insects

Wildlife

Abiotic factors



Entomology

Plant Pathology

Weed Management

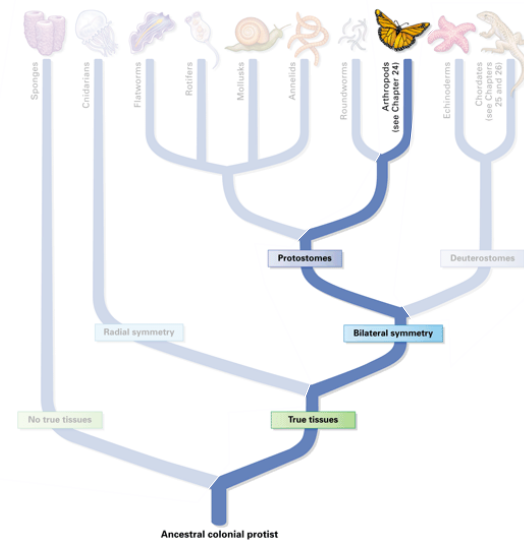
Insects

Wildlife

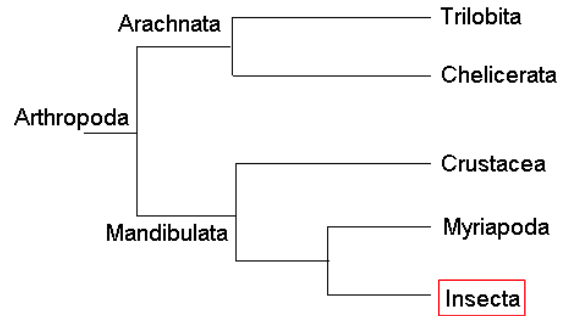
Abiotic factors



Insects



Insects



Human Ag. in Constant
battle with little aliens

Human Ag. in Constant
battle with little aliens



Human Ag. in Constant
battle with little aliens



Human Ag. in Constant
battle with little aliens



© Erfan Vafaie 2015

TEXAS A&M
AGRI LIFE
EXTENSION

Human Ag. in Constant
battle with little aliens



© Erfan Vafaie 2015

TEXAS A&M
AGRI LIFE
EXTENSION

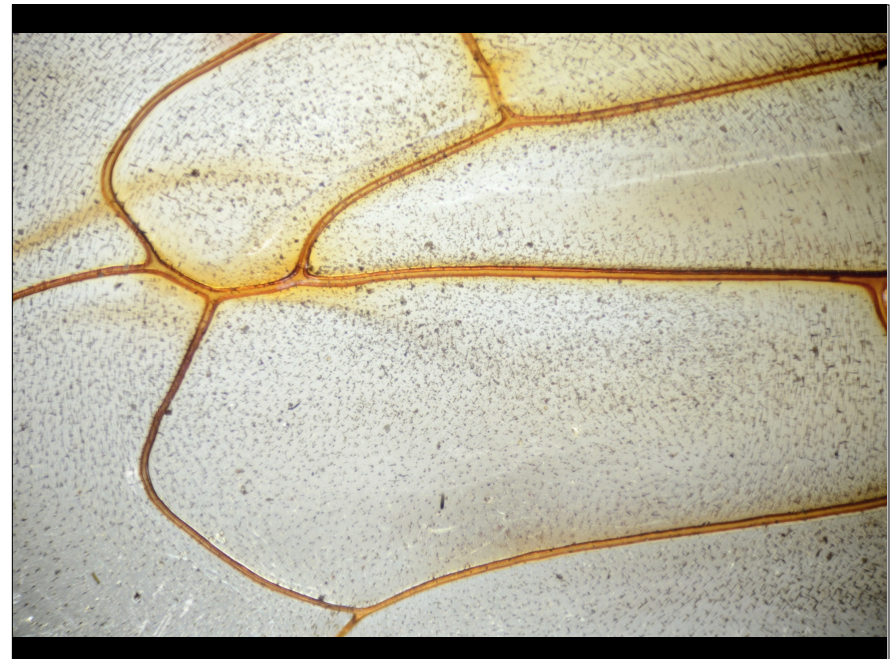




Photo: [Linden Gledhill](#)

What are insects and mites?

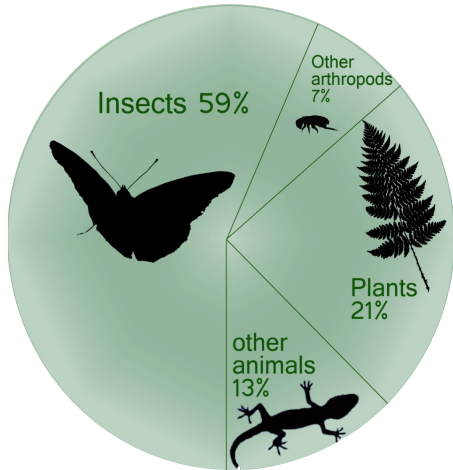
- Phylum Arthropoda
- bilaterally symmetrical
- hard outer exoskeleton
- segmented bodies
- jointed legs



Arthropod Examples

- Lobsters, crabs, shrimp (Crustacea)
- Spiders, mites, scorpions (Arachnida)
- Centipedes, millipedes (Chilopoda)
- Insects (Hexapoda)

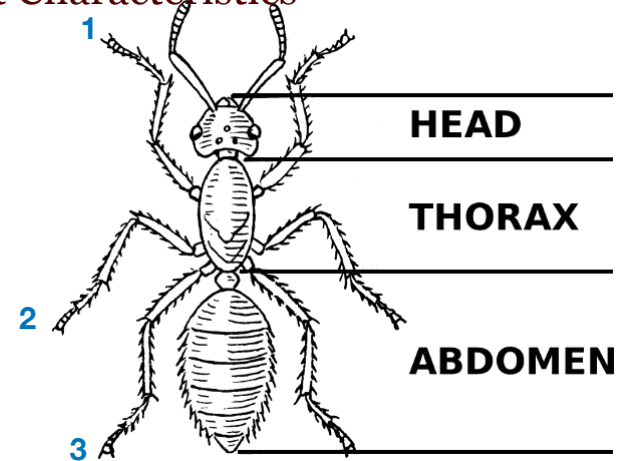
The most diverse life form on the planet



Recent estimates of species diversity

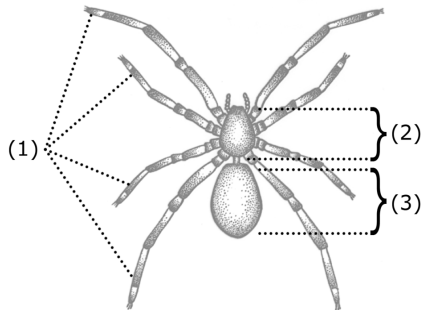
- 1.2 million species described
 - Total estimated species count: 8.7 million (Eukaryotes)
 - 2.2 million marine
 - 86% of existing species undescribed (96% of marine species)
- (Mora et al. 2011)

Insect Characteristics

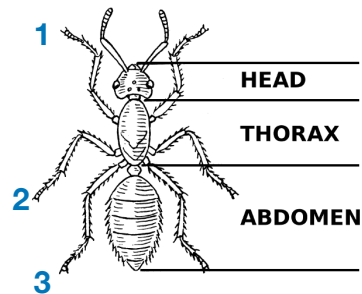


jmgkids.us

Insect Characteristics



CDC Public Health Image Library



jmgkids.us

Head: Center for sensory perception

- Eyes
- Palpi
- Antennae

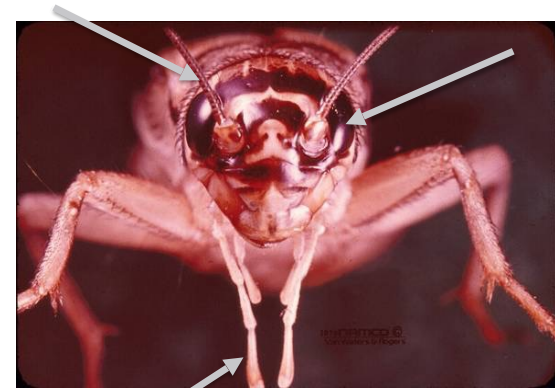


Photo © Van Waters & Rogers /

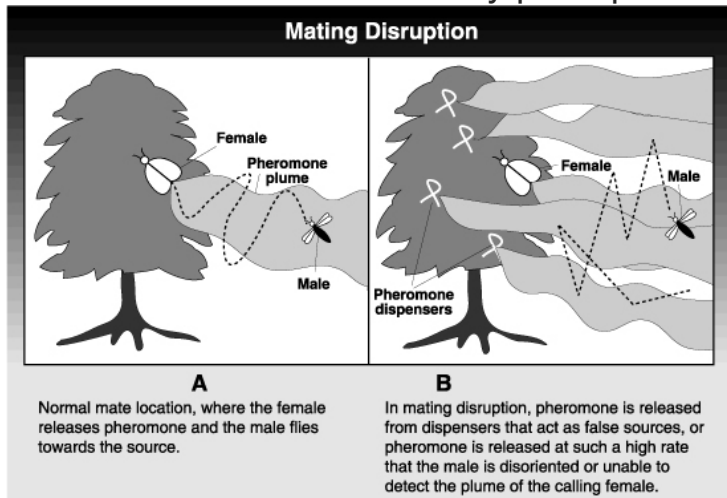
Head: Center for sensory perception



Head: Center for sensory perception



Head: Center for sensory perception



Head: Center for sensory perception

Peachtree Borer Mating Disruption

Information on the Use of ISOMATE P Pheromone to Suppress Peachtree Borer in Nursery Production

A
Normal mate location, where the female releases pheromone and the male flies towards the source.

B
In mating disruption, pheromone is released from dispensers that act as false sources, or pheromone is released at such a high rate that the male is disoriented or unable to detect the plume of the calling female.

Oregon State UNIVERSITY OSU

Robin Rosetta
Department of Horticulture
OSU-NWREC

A&M LIFE EXTENSION

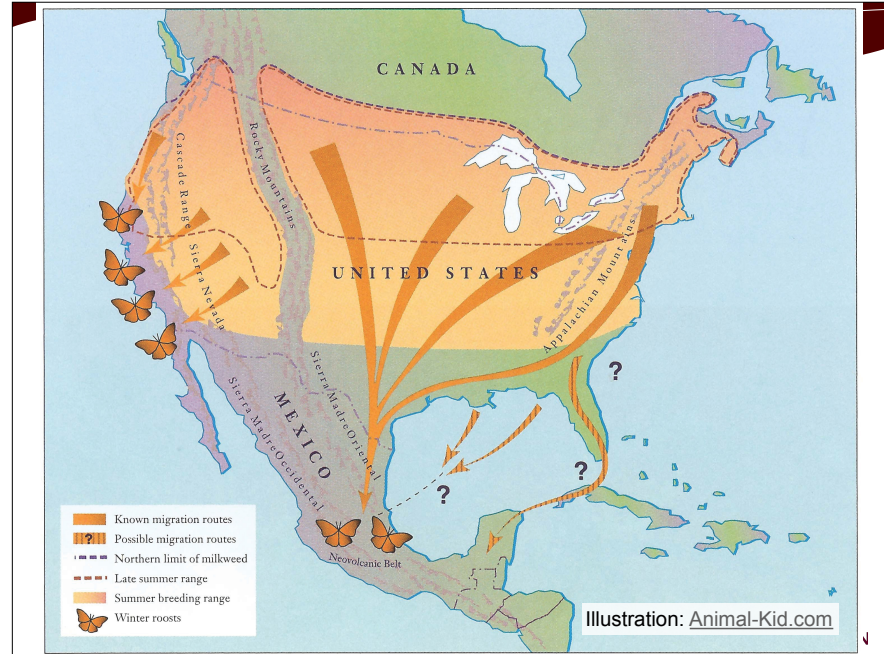


- Legs
- Wings

Thorax: Center for movement

Photo © Van Waters & Rogers /

TEXAS A&M
AGRI LIFE
EXTENSION



Monitor Tools of the Trade

Thorax: Center for movement

A

B

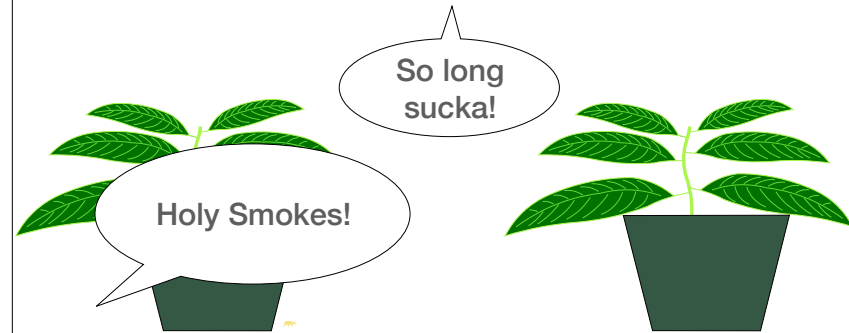
C

D

E

Physical/Mechanical

Netting



Monitor Tools of the Trade

Thorax: Center for movement



Figure 15. Proper use of a sweep net.

Photo: [NC State University](#)

- Reproductive organs
- Digestive tract
- Defensive glands
- Communication glands



Abdomen:

Photo © Van Waters & Rogers / Univar

Insect exoskeleton



Photo © Van Waters & Rogers / 33

- Made of chitinous proteins
- Lightweight
- strong
- resilient
- ideal for small organisms
- Covered with wax layers for waterproofing

Insect exoskeleton



Photo © Van Waters & Rogers / 34

Pesticides designed to affect insect skeletal systems:

- Diatomaceous earth
- Abrades insect cuticles
- Silica aerogels
- Absorbs waxes from exoskeleton



Note: Dessiccants only really effective in dry environments.

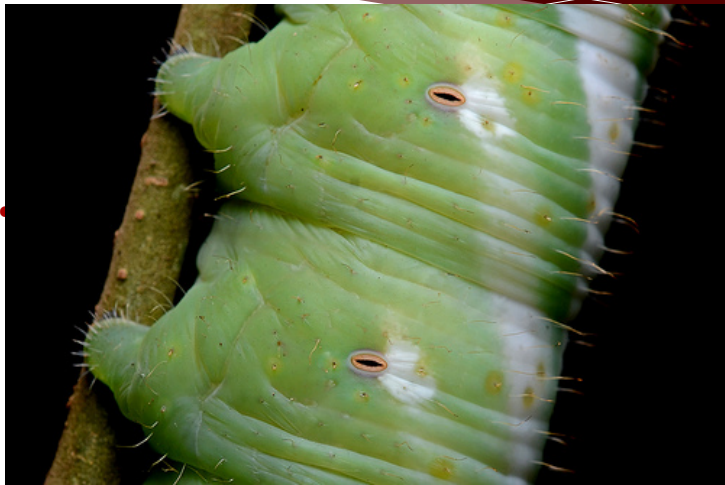
35

- Simple series of tubes and openings
- Spiracles
- Tracheae



Insect respiratory system

36

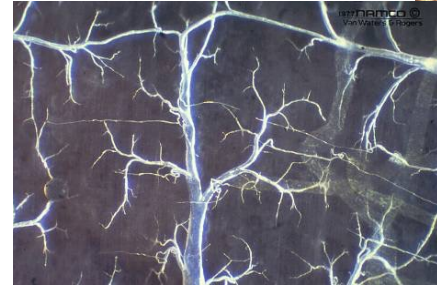


Insect respiratory system

37

Respiratory system

Spiracle



Trachea

Photo © Van Waters & Rogers /Univar

Respiratory system



39

Oil: An insecticide for all spiracles

- Horticultural oil
- Vegetable oils
- Mineral oils



armored scales

mosquito larva



How insects grow and develop

- Molting occurs during immature stages
- Stages between molts called “instars”



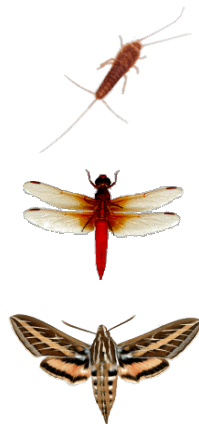
Cicada nymph final molt



Courtesy USDAARS image gallery

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



Gradual metamorphosis

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

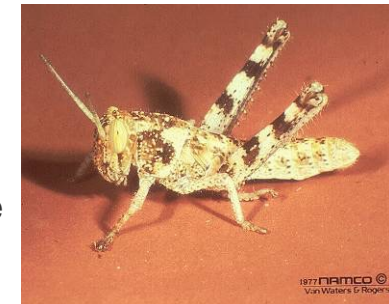


Photo © Van Waters & Rogers / Univar

Gradual metamorphosis



Egg



Nymph



Adult

Photos © Van Waters & Rogers / Univar

45

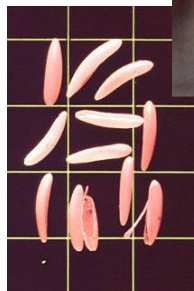
Complete metamorphosis

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



46

Complete metamorphosis



Eggs



Larvae



Pupa



Adult



Photos © Van Waters & Rogers /

47

Pesticides designed to affect insect moulting

Insect growth regulators:

- Azadirachtin
- Hydroprene
- Methoprene
- Pyriproxyfen
- Triflumuron

Healthy

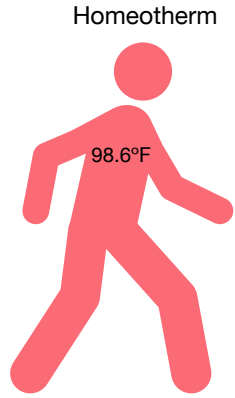
Not-so-healthy



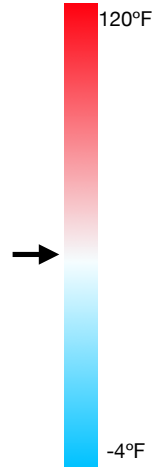
Photos from Patrick Rydzak

48

Insect Thermoregulation

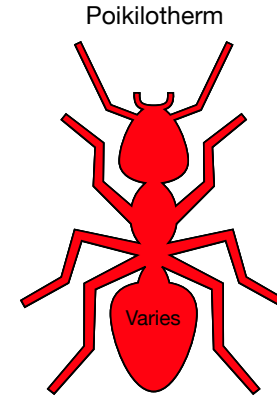
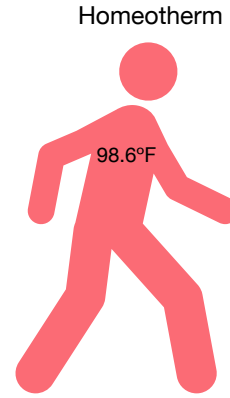


Ambient Temperature

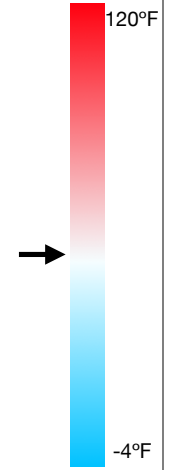


TEXAS A&M
AGRI LIFE
EXTENSION

Insect Thermoregulation



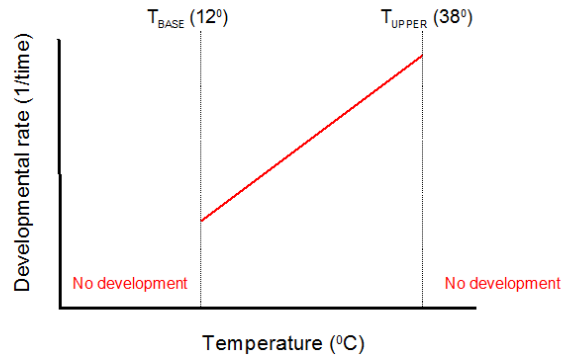
Ambient Temperature



TEXAS A&M
AGRI LIFE
EXTENSION

Insect Development Rate

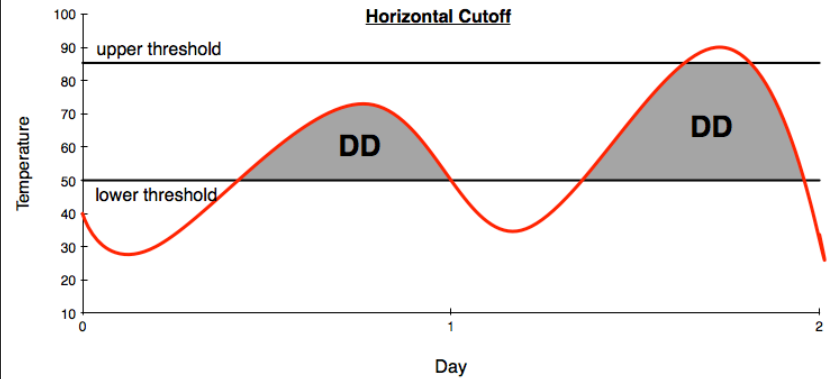
Growing degree days & development



Grasshoppers and Climate Change

TEXAS A&M
AGRI LIFE
EXTENSION

Insect Development Rate



Decision Aid System

TEXAS A&M
AGRI LIFE
EXTENSION

Insects | A Word About “Cold Weather”

Freeze Tolerance



Woolly Bear
-20°C (-4 F) while frozen

Photo: Andrew Rothstein

Freeze Avoidance

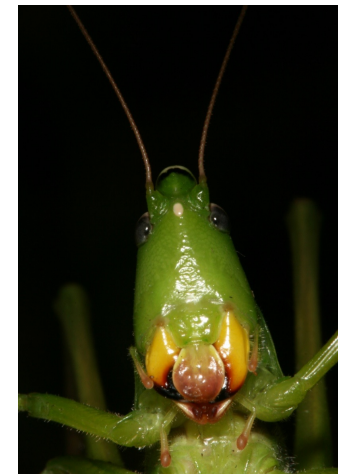
Ips acuminatus
-29.2 °F using polyols (low weight anti-freezes)



Photo: Maja Jurc, University of Ljubljana, bugwood.org uga2103050

Types of mouthparts

- Chewing
 - crickets, termites, beetles, caterpillars
- Piercing/sucking
 - plant bugs, fleas, lice, mites, hoppers
- Sponging
 - some flies
- Siphoning
 - moths and butterflies



AGRILIFE
EXTENSION

54

- Side to side movement
- Upper lip: labrum
- Jaws: mandibles, maxillae
- Tongue: hypopharynx
- Lower lip: labium
- Chewing, boring, mining damage possible

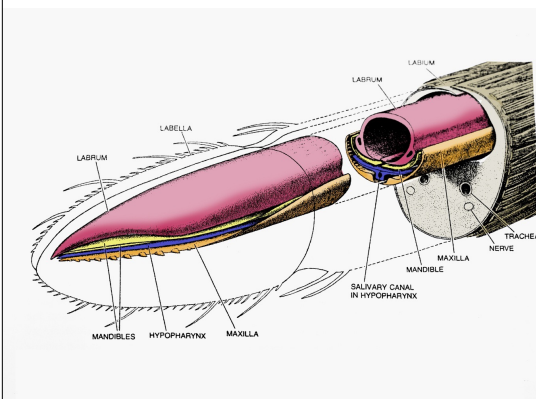


Chewing mouthparts

TEXAS A&M
AGRILIFE
EXTENSION

55

Piercing/sucking mouthparts



- Microscopic food channel for liquids
- Plant wilting, honeydew, disease transmission possible

TEXAS A&M
AGRILIFE
EXTENSION

56

Piercing sucking mouthparts

- Usually folded under body, between legs



Milkweed bug, *Oncopeltus fasciatus*



Photo by [Curtis Starn](#)

Sponging mouthparts

- Sponge-like *labella* on certain flies
- Capable of feeding only on exposed liquids such as nectar or sap
- Capable of transmitting pathogens in the house fly & blow fly



Siphoning mouthparts

- Flexible maxillae form soda-straw like mouthparts
- Incapable of piercing skin or plant surfaces.

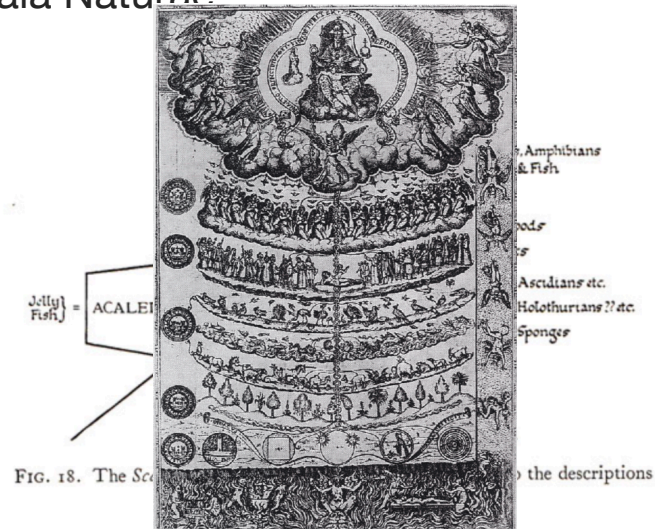


61

How insects are classified and named

62

Scala Naturae



384 - 322 B.C.E.

Carl Linnaeus

(Carolus Linnaeus) 1707-1778

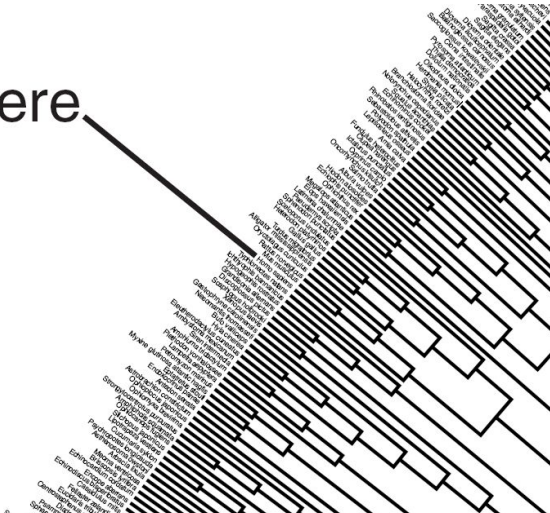


- Father of Taxonomy
- Professor, Uppsala University, Sweden
- *Species Plantarum* (1753), *Genera Plantarum* (1754) and *Systema Naturae* (1758) standard reference for naming plants and animals
- Named 4,400 species animals and 7,700 plants
- Created binomial nomenclature

64

Taxonomic Tree

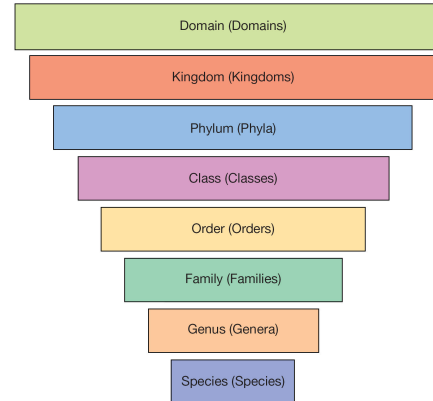
You are here



Linnaeus' created a taxonomy

How animals are classified

(> Greek: taxa=to arrange, classify or place)



Memory aide



King Philip Came Over From
Gloria Spain

Kingdom, Phylum, Class, Order,
Family, Genus, Species

A word about scientific names..

Blatella germanica (Linnaeus)

Genus species (Author)



- Common names:
- German cockroach (U.S.)
- steamfly (U.S.)
- waterbug (U.S.)
- cucaracha (Spanish)
- küchenschabe (German)
- *&#@\$!!* (universal)

Wild and crazy names

- Tropical canopy-inhabiting beetles by Terry Irwin
 - *Agra vation*
 - *Agra cadabra*
 - *Agra katewinslettae* (ESA Newsl. 9/2005)
- Golden “bootied” fly by Bryan Lessard (CSIRO)
 - *Scaptia beyonceae* is “Bootylicious”



EXTENSION

Wild and crazy names

- Hemipteran genera described by G. W. Kirkaldy in 1904
 - *Ochisme* (sounds like O kiss me)
 - *Polychisme*
 - *Peggichisme*
 - *Dolichisme*, etc. (Berenbaum 1993)
- Three species of slime mold beetles named by Q. Wheeler and K. Miller in 2005
 - *Agathidium bushi*
 - *Agathidium cheneyi*
 - *Agathidium rumsfeldi* (ESA Newsl. May 2005, *Bull. Am. Mus. Nat. Hist.* 291 (1), 1-167)

TEXAS A&M
AGRI LIFE
EXTENSION

70



PHOTO BY ESTELLA ORTEGA, ANTWEB.ORG

Tetramorium jedi

Polemistus chewbacca
Polemistus vaderi
Polemistus yoda

- Lots more at: <http://home.earthlink.net/~misaak/taxonomy/taxPuns.html>

TEXAS A&M
AGRI LIFE
EXTENSION

71

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)

TEXAS A&M
AGRI LIFE
EXTENSION

72