

ENTOMOLOGY

3 or 4 Member Team

I. PURPOSE

The insect contest introduces high school students to the fundamentals of entomology and develops skills in identification of common insects and their relatives using taxonomy and nomenclature used by practitioners in the industry and in the scientific community. Understanding insects and key species is of utmost importance to agricultural crops and animal production, conservation, human and companion animal health and well being. The basic entomological principles to be covered include: 1) insect structure and function, 2) metamorphosis, 3) insect identification, and 4) importance to people. The event is supported by curriculum of the following agriculture food and natural resource coursework: Principles of Agriculture, Food, and Natural Resources, Livestock Production, Small Animal Mgt., Equine Science, Advanced Animal Science, Landscape Design, Turf Grass Mgt., Horticultural Sciences, Advanced Plant and Soil Science, Practicums in Agriculture, Food, and Natural Resources, Applied Entomology, and Veterinary Medical Applications.

1. Insect Structure and Function

To identify insects and understand their role in the environment, one must be acquainted with basic anatomy. Important features include types of mouthparts (chewing, piercing-sucking, siphoning, cutting lapping, sponging, etc.), types of legs (jumping, grasping, digging, swimming, running, etc.) and various modifications of wings, antennae, and other body parts. Anatomical features are useful in identifying habitat and food source. For example, we know that the praying mantis is an excellent predator because its front legs are modified to grasp prey and because it has chewing mouthparts.

2. Metamorphosis

All insects undergo metamorphosis, a change in body form, as they develop from egg to adult. Some insects undergo more complex changes than others, and consequently, identification of certain insects can be confused by the dissimilarity between immature and adult stages. The caterpillar and butterfly are common examples. In general, insect metamorphosis can be categorized into one of three types. Students should know to what metamorphic type each insect order belongs.

A. Ametabolous - no metamorphosis (immature stages and adults are similar: wingless as adults)

B. Hemimetabolous – incomplete or gradual metamorphosis (immature stages resemble adults but without wings and wing buds.)

C. Holometabolous – complete metamorphosis (immature stages do not resemble adults)

3. Insect Identification

The fundamental step in insect identification is recognition of order. All insects are classified into approximately 31 groups called orders. Each insect order shares a set of characteristic biological and anatomical features. Proper interpretation of mouthparts, wings, etc. aid in order recognition. Entomology students should be able to identify and differentiate between insects and a

variety of other arthropods.

4. Significance to People

The significance of any insect to people in agriculture, medicine, etc. is of great practical importance. Most insects are not harmful; in fact, many are considered beneficial. For this reason, people should know the difference between pest insects and beneficial insects. Also, some insects cannot be classified as either pest or beneficial. These insects are neutral or variable as far as people are concerned. Failure to discriminate among these insects can lead to serious economic losses and other problems.

II. TEAM MAKE UP

Three or four individuals per school form a team. All members will be scored and the top three scores will count toward the team total.

III. Event Format

1. The event will consist of 25 unlabeled, preserved specimens selected from a list of 150.
2. The student contestants will identify for each specimen, the order, common name, metamorphic type, mouthpart type, and significance to people.
3. Each student will be given 90 seconds per specimen. At the end, when contestants have examined all specimens, additional time may be given to complete the scan sheets following identification of the insects.

IV. SCORING

Order2 points/specimen
Common name3 points/specimen
Metamorphosis..... 1 point/specimen
Type of mouthparts1 point/specimen
Significance to people ..1 point/specimen

Total Points Individual200points

Total Team600 points

V. TIEBREAKERS

Team and individual ties will be broken using the following tiebreakers:

1. High score on orders
2. If still tied, high score on common names.
3. If still tied, high score on metamorphosis
4. If still tied, high score on mouthparts
5. If still tied, the highest alternate score
6. If still tied, winner will be determined by coin toss.

VI. RESOURCES

Each team should acquire a study list of 150 arthropods and their characteristics upon which the event will be based. Extensive entomological literature is available in school

and public libraries. Field guides to the insects are particularly useful. Many insect images are also available on a variety of websites. Each local agricultural science and technology department should consider building their own insect reference collection. Collecting insects for study is an enjoyable activity and collections may be preserved for future instructional and chapter activities. Instructions for collecting and preserving insects are available in most entomological textbooks. The collegiate entomology faculty recommends the following text as the standard for insect biology and identification: Triplehorn, C.A. and N.E. Johnson. 2005. Borror and DeLong's Introduction to the Study of Insects, 7th edition; Thomson Learning, Inc., Belmont, CA

STATE FFA ENTOMOLOGY CONTEST

Common Name Order Metamorphosis Mouthpart Significance

	Common Name	Order	Metamorphosis	Mouthpart	Significance
001	American cockroach	Blattodea	Hemimetabolous	Chewing	Pest
002	antlion	Neuroptera	Holometabolous	Chewing	Beneficial
003	antlion larva**	Neuroptera	Holometabolous	Chewing	Beneficial
004	aphid	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
005	armored scale	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
006	assassin bug	Hemiptera	Hemimetabolous	Pierce-sucking	Beneficial
007	backswimmer	Hemiptera	Hemimetabolous	Pierce-sucking	Beneficial
008	bagworm**	Lepidoptera	Holometabolous	Chewing	Pest
009	banded wing grasshopper	Orthoptera	Hemimetabolous	Chewing	Pest
010	bed bug	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
011	beet armyworm	Lepidoptera	Holometabolous	Chewing	Pest
012	big-eyed bug	Hemiptera	Hemimetabolous	Pierce-sucking	Beneficial
013	biting louse	Phthiraptera	Hemimetabolous	Chewing	Pest
014	black widow spider	non-insect	Ametabolous	Not Applicable	Pest
015	blister beetle	Coleoptera	Holometabolous	Chewing	Pest
016	blow fly	Diptera	Holometabolous	Sponging	Pest
017	boll weevil	Coleoptera	Holometabolous	Chewing	Pest
018	bollworm**	Lepidoptera	Holometabolous	Chewing	Pest
019	boxelder bug	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
020	book louse	Psocoptera	Ametabolous	Chewing	Pest
021	brown dog tick	non-insect	Ametabolous	Pierce-sucking	Pest
022	brown recluse spider	non-insect	Ametabolous	Not Applicable	Pest
023	bumble bee	Hymenoptera	Holometabolous	Chewing-lapping	Variable
024	cabbage looper**	Lepidoptera	Holometabolous	Chewing	Pest
025	carpet beetle	Coleoptera	Holometabolous	Chewing	Pest
026	carrion beetle	Coleoptera	Holometabolous	Chewing	Beneficial
027	cattle grub**	Diptera	Holometabolous	Chewing	Pest
028	centipede	non-insect	Ametabolous	Not Applicable	Variable
029	cicada	Hemiptera	Hemimetabolous	Pierce-sucking	Variable
030	cicada killer	Hymenoptera	Holometabolous	Chewing	Beneficial
031	cigarette beetle	Coleoptera	Holometabolous	Chewing	Pest
032	click beetle	Coleoptera	Holometabolous	Chewing	Variable
033	Colorado potato beetle	Coleoptera	Holometabolous	Chewing	Pest
034	crab spider	non-insect	Ametabolous	Not Applicable	Beneficial
035	crane fly	Diptera	Holometabolous	Pierce-sucking	Variable
036	damsel bug	Hemiptera	Hemimetabolous	Pierce-sucking	Beneficial
037	damselfly	Odonata	Hemimetabolous	Chewing	Beneficial

038	damselfly nymph**	Odonata	Hemimetabolous	Chewing	Beneficial
039	darkling beetle	Coleoptera	Holometabolous	Chewing	Variable
040	deer fly	Diptera	Holometabolous	Cutting-Sponging	Pest
041	deer ked	Diptera	Holometabolous	Pierce-sucking	Pest
042	dobsonfly	Neuroptera	Holometabolous	Chewing	Beneficial
043	dragonfly	Odonata	Hemimetabolous	Chewing	Beneficial
044	dragonfly nymph**	Odonata	Hemimetabolous	Chewing	Beneficial
045	dung beetle	Coleoptera	Holometabolous	Chewing	Beneficial
046	earwing	Dermaptera	Hemimetabolous	Chewing	Beneficial
047	elm leaf beetle	Coleoptera	Holometabolous	Chewing	Pest
048	fall webworm**	Lepidoptera	Holometabolous	Chewing	Pest
049	field cricket	Orthoptera	Hemimetabolous	Chewing	Pest
050	firefly	Coleoptera	Holometabolous	Chewing	Beneficial
051	flea	Siphonaptera	Holometabolous	Pierce-sucking	Pest
052	flea beetle	Coleoptera	Holometabolous	Chewing	Pest
053	flesh fly	Diptera	Holometabolous	Sponging	Pest
054	garden spider	non-insect	Ametabolous	Not Applicable	Beneficial
055	German cockroach	Blattodea	Hemimetabolous	Chewing	Pest
056	giant water bug	Hemiptera	Hemimetabolous	Pierce-sucking	Beneficial
057	gray hairstreak	Lepidoptera	Holometabolous	Siphoning	Pest
058	green June beetle	Coleoptera	Holometabolous	Chewing	Pest
059	green lace wing	Neuroptera	Holometabolous	Chewing	Beneficial
060	ground beetle	Coleoptera	Holometabolous	Chew	Beneficial
061	harlequin bug	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
062	harvestman	non-insect	Ametabolous	Not Applicable	Variable
063	hellgrammite**	Neuroptera	Holometabolous	Chewing	Beneficial
064	honey bee	Hymenoptera	Holometabolous	Chewing-lapping	Beneficial
065	horn fly	Diptera	Holometabolous	Cutting- lapping	Pest
066	horntail wasp	Hymenoptera	Holometabolous	Chewing	Pest
067	horse fly	Diptera	Holometabolous	Cutting-Sponging	Pest
068	house fly	Diptera	Holometabolous	Sponging	Pest
069	ichneumon wasp	Hymenoptera	Holometabolous	Chewing	Beneficial
070	Indian meal moth	Lepidoptera	Holometabolous	siphoning	Pest
071	ironclad beetle	Coleoptera	Holometabolous	Chewing	Variable
072	Jerusalem cricket	Orthoptera	Hemimetabolous	Chewing	Variable
073	jumping spider	non-insect	Ametabolous	Not Applicable	Beneficial
074	katydid	Orthoptera	Hemimetabolous	Chewing	Variable
075	lace bug	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
076	lacewing larva**	Neuroptera	Holometabolous	Chewing	Beneficial
077	ladybird beetle	Coleoptera	Holometabolous	Chewing	Beneficial
078	ladybird beetle larva**	Coleoptera	Holometabolous	Chewing	Beneficial

079	leaf-footed bug	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
080	leafhopper	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
081	longhorned beetle	Coleoptera	Holometabolous	Chewing	Pest
082	luna moth	Lepidoptera	Holometabolous	Siphoning	Beneficial
083	mantidfly	Neuroptera	Holometabolous	Chewing	Beneficial
084	May beetle	Coleoptera	Holometabolous	Chewing	Pest
085	mayfly	Ephemeroptera	Hemimetabolous	Vestigial	Beneficial
086	mealybug	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
087	metallic woodboring beetle	Coleoptera	Holometabolous	Chewing	Pest
088	milkweed bug	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
089	millipede	non-insect	Ametabolous	Chewing	Beneficial
090	minute pirate bug	Hemiptera	Hemimetabolous	Pierce-sucking	Beneficial
091	mole cricket	Orthoptera	Hemimetabolous	Chewing	Pest
092	monarch butterfly	Lepidoptera	Holometabolous	Siphoning	Beneficial
093	sweet potato weevil	Coleoptera	Holometabolous	Chewing	Pest
094	mosquito	Diptera	Holometabolous	Pierce-sucking	Pest
095	mud-dauber wasp	Hymenoptera	Holometabolous	Chewing	Variable
096	Oriental cockroach	Blattodea	Hemimetabolous	Chewing	Pest
097	painted lady	Lepidoptera	Holometabolous	Siphoning	Beneficial
098	paper wasp	Hymenoptera	Holometabolous	Chewing	Variable
099	pillbug	non-insect	Ametabolous	Chewing	Variable
100	praying mantis	Mantodea	Hemimetabolous	Chewing	Beneficial
101	predaceous diving beetle	Coleoptera	Holometabolous	Chewing	Beneficial
102	red admiral	Lepidoptera	Holometabolous	siphoning	Beneficial
103	red flour beetle	Coleoptera	Holometabolous	Chewing	Pest
104	red harvester ant	Hymenoptera	Holometabolous	Chewing	Pest
105	red imported fire ant	Hymenoptera	Holometabolous	Chewing	Pest
106	rice weevil	Coleoptera	Holometabolous	Chewing	Pest
107	robber fly	Diptera	Holometabolous	Pierce-sucking	Beneficial
108	rove beetle	Coleoptera	Holometabolous	Chewing	Beneficial
109	sawtoothed grain beetle	Coleoptera	Holometabolous	Chewing	Pest
110	scorpion	non-insect	Ametabolous	Chewing	Pest
111	scorpion fly	Mecoptera	Holometabolous	Chewing	Beneficial
112	silverfish	Thysanura	Ametabolous	Chewing	Pest
113	skipper butterfly	Lepidoptera	Holometabolous	Siphoning	Variable
114	snakefly	Neuroptera	Holometabolous	Chewing	Beneficial
115	soft scale	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
116	soldier beetle	Coleoptera	Holometabolous	Chewing	Beneficial
117	southwestern corn borer**	Lepidoptera	Holometabolous	Chewing	Pest
118	sphinx moth	Lepidoptera	Holometabolous	Siphoning	Variable
119	spider mite	non-insect	Ametabolous	Pierce-sucking	Pest

120	spinose ear tick	non-insect	Ametabolous	Pierce-sucking	Pest
121	spittlebug	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
122	spotted cucumber beetle	Coleoptera	Holometabolous	chewing	Pest
123	springtail	Collembola	Ametabolous	chewing	Variable
124	squash bug	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
125	stag beetle	Coleoptera	Holometabolous	Chewing	Variable
126	stonefly	Plecoptera	Hemimetabolous	Chewing	Beneficial
127	sucking louse	Phthiraptera	Hemimetabolous	Pierce-sucking	Pest
128	sulphur butterfly	Lepidoptera	Holometabolous	Siphoning	Pest
129	swallowtail butterfly	Lepidoptera	Holometabolous	Siphoning	Beneficial
130	syrphid fly	Diptera	Holometabolous	Sponging	Variable
131	tarantula hawk	Hymenoptera	Holometabolous	Chewing	Variable
132	tarnished plant bug	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
133	termite	Isoptera	Hemimetabolous	Chewing	Pest
134	thrip	Thysanoptera	Hemimetabolous	Rasping-sucking	Variable
135	tiger beetle	Coleoptera	Holometabolous	Chewing	Beneficial
136	toad bug	Hemiptera	Hemimetabolous	Pierce-sucking	Beneficial
137	tobacco hornworm**	Lepidoptera	Holometabolous	Chewing	Pest
138	tree cricket	Orthoptera	Hemimetabolous	Chewing	Variable
139	treehopper	Hemiptera	Hemimetabolous	Pierce-sucking	Pest
140	trichograma wasp	Hymenoptera	Holometabolous	Chewing	Beneficial
141	tumbling flower beetle	Coleoptera	Holometabolous	Chewing	Variable
142	velvet ant	Hymenoptera	Holometabolous	Chewing	Variable
143	viceroy butterfly	Lepidoptera	Holometabolous	Siphoning	Beneficial
144	vinegaroon	non-insect	Ametabolous	Chewing	Variable
145	walkingstick	Phasmatodea	Hemimetabolous	Chewing	Variable
146	water boatman	Hemiptera	Hemimetabolous	Pierce-sucking	Beneficial
147	water strider	Hemiptera	Hemimetabolous	Pierce-sucking	Beneficial
148	whirligig beetle	Coleoptera	Holometabolous	Chewing	Beneficial
149	white grub**	Coleoptera	Holometabolous	Chewing	Pest
150	whitefly	Hemiptera	Hemimetabolous	Pierce-sucking	Pest

** Denotes larval or nymphal form

COMMON INSECT ORDERS AND GENERAL CHARACTERISTICS

(01) Order: **Blattodea** Common name: Cockroach Metamorphosis: Hemimetabolous
Mouthparts: Chewing Key characteristics: Flattened body, head concealed by pronotum
Significance: Pest

(02) Order: **Coleoptera** Common name: Beetles Metamorphosis: Holometabolous
Mouthparts: Chewing Key characteristics: Elytra are hard and shield-like, meeting in a straight midline Significance: Pest, beneficial, and variable

(03) Order: **Collembola** Common name: Springtail Metamorphosis: Ametabolous
Mouthparts: Chewing Key characteristics: Minute, wingless, with spring-like apparatus on abdomen Significance: Variable

(04) Order: **Dermaptera** Common name: Earwig Metamorphosis: Hemimetabolous
Mouthparts: Chewing Key characteristics: Forceps-like cerci at the tip of the abdomen
Significance: Beneficial

(05) Order: **Diptera** Common name: Fly, midge, mosquito, etc. Metamorphosis: Holometabolous
Mouthparts: Piercing-sucking, cutting-sponging, sponging, chewing, cutting-lapping Key characteristics: Second pair of wings reduced to halteres
Significance: Pest, beneficial, or variable

(06) Order: **Ephemeroptera** Common name: Mayfly Metamorphosis: Hemimetabolous
Mouthparts: Vestigial Key characteristics: triangle-shaped wings with hind smaller, 2-3 tail-like appendages at tip of abdomen Significance: Beneficial

(07) Order: **Hemiptera** Common name: True bugs (assassin, damsel, minute, toad, etc.), cicada, hopper, scale, aphid, etc. Metamorphosis: Hemimetabolous
Mouthparts: Piercing-sucking Key characteristics: Hemelytra or clear front wings Significance: Beneficial, pest or variable

(09) Order: **Hymenoptera** Common name: Ant, bee, wasp Metamorphosis: Holometabolous
Mouthparts: Chewing, chewing-lapping Key characteristics: Membranous wings with few veins, front pair larger than rear Significance: Pest, beneficial, or variable

(10) Order: **Isoptera** Common name: Termite Metamorphosis: Hemimetabolous
Mouthparts: Chewing Key characteristics: Bead-like antennae, thorax broadly joined to abdomen Significance: Pest or beneficial

(11) Order: **Lepidoptera** Common name: Butterfly and moth Metamorphosis: Holometabolous
Mouthparts: Siphoning, chewing Key characteristics: Wings covered with scales Significance: Pest, beneficial, or variable

(12) Order: **Mantodea** Common name: Praying mantis Metamorphosis: Hemimetabolous
Mouthparts: Chewing Key characteristics: Raptorial front legs Significance: Beneficial

(13) Order: **Mecoptera** Common name: Scorpionfly Metamorphosis: Holometabolous
Mouthparts: Chewing Key characteristics: Head prolonged as a beak below the eyes Significance: Beneficial

(14) Order: **Neuroptera** Common name: Lacewing, antlion, dobsonfly, etc. Metamorphosis: Holometabolous
Mouthparts: Chewing Key characteristics: Membranous wings with numerous veins including ladder-like cross veins at front margin Significance: Beneficial

(15) Order: **Odonata** Common name: Dragonfly and damselfly Metamorphosis: Hemimetabolous
Mouthparts: Chewing Key characteristics: Large faceted compound

eyes occupy most of the head, 4 elongate wings with nodus in front margin

Significance: Beneficial

(16) Order: **Orthoptera** Common name: Grasshopper, cricket, katydid Metamorphosis: Hemimetabolous Mouthparts: Chewing Key characteristics: Front wings parchment-like, long antennae, hind legs modified for jumping Significance: Variable or Pest

(17) Order: **Phasmatodea** Common name: Walkingstick Metamorphosis: Hemimetabolous Mouthparts: Chewing Key characteristics: Elongate sticklike body Significance: Variable

(18) Order: **Phthiraptera** Common name: Sucking and biting lice Metamorphosis: Hemimetabolous Mouthparts: Piercing-sucking or chewing Key characteristics: Wingless, flattened, crab-like legs, modified for clinging to host Significance: Pest

(19) Order: **Plecoptera** Common name: Stonefly Metamorphosis: Hemimetabolous Mouthparts: Chewing Key characteristics: Cerci present, may be long or short Significance: Beneficial

(20) Order **Psocoptera** Common name: Booklice Metamorphosis: Ametabolous Mouthparts: Chewing Key characteristics: Wingless (but some other species may have 4 wings), long antennae, soft bodies Significance: Pest

(21) Order: **Siphonaptera** Common name: Flea Metamorphosis: Holometabolous Mouthparts: Piercing-sucking Key characteristics: Wingless, flattened laterally, jumping hind legs, combs Significance: Pest

(22) Order: **Thysanoptera** Common name: Thrips Metamorphosis: Hemimetabolous Mouthparts: Piercing - sucking Key characteristics: Minute, wingless or winged with 2 or 4 feather-like wings Significance: Variable

(23) Order: **Thysanura** Common name: Silverfish Metamorphosis: Ametabolous Mouthparts: Chewing Key characteristics: Wingless with 3 thread-like filaments at the tip of the abdomen Significance: Pest

(24) Order: **non-insects**