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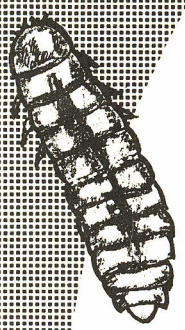
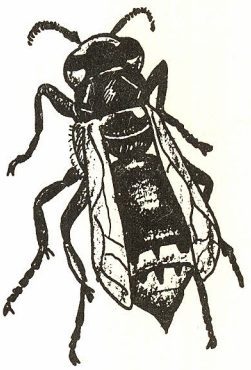
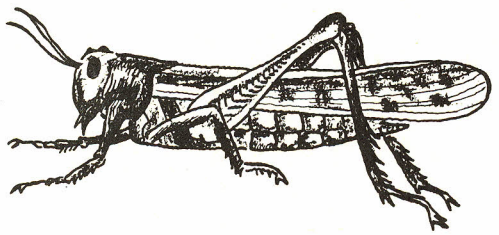
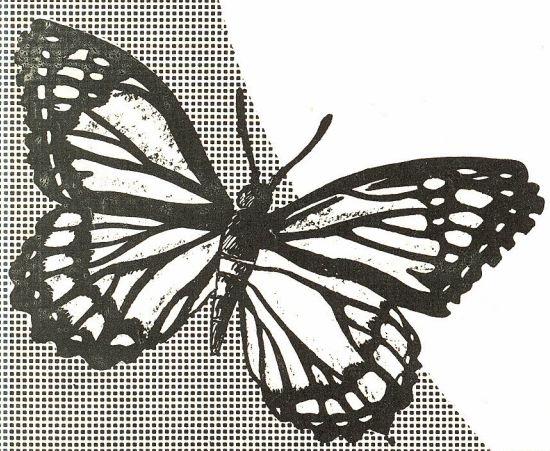
NEBRASKA 4-H

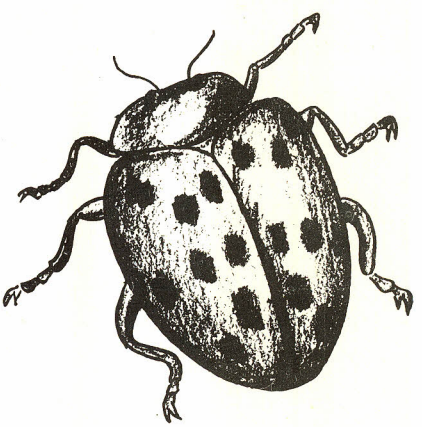
ENTOMOLOGY CLUB MANUAL











EXTENSION SERVICE
UNIVERSITY OF NEBRASKA COLLEGE OF AGRICULTURE
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NEBRASKA 4-H ENTOMOLOGY CLUB MANUAL

by

Robert E. Roselle

Insects have probably been present on earth longer than most other living things as we know them today. In numbers of species they make up over seventy per cent of the known species of animals in the world. They vary in size from microscopic organisms to the great moths and grasshoppers of the tropics measuring nearly twelve inches in wing spread or length. Among the insects we find the only form of social life existing in the animals without back bones. Of the tremendous numbers of insects, only two have been domesticated, the honey bee and the silk worm.

The study of these interesting animals is one of the most fascinating hobbies a boy or girl can pursue, and the knowledge gained thereby is of great value. Insects show a never-ending variety of colors, sizes, shapes and habits. They present the lowest to the highest social organizations and the simplest to the most complex life histories. No other animal can change from a caterpillar to a beautiful moth.

A few species of insects cause millions of dollars in damage each year. The United States Department of Agriculture estimates that losses due to insects exceed four billions yearly. On the other hand, it is doubtful if animal life would survive without insects. They are one of the most important factors in nature, and present a challenge to youth to learn more and more about them.

Collecting Insects

Insects may be collected all year. They are most numerous during the warm days of spring, summer and fall. Favorite places to look for insects are: (1) Flowers for butterflies, moths, and bees. (2) Under rocks and boards for beetles and many other kinds. (3) On trees and shrubs for leaf hoppers, tree hoppers, and leaf beetles. (4) On fermenting fruits, for the insect drunkards -- mostly butterflies, moths, beetles, bees and flies. (5) Dead animals for scavenger beetles. (6) In the vegetable garden for the many pests of the garden. (7) Legumes for a never-ending variety of bugs and bees. (8) Corn fields for rootworm beetles, corn borers, aphids and aphid lions. (9) Grasses and weeds (a wonderful source of insect specimens when a sweep net is used). (10) Everywhere! Insects may be found in almost every situation. Do not overlook the insects that live in water or on animals.

Killing Bottles: After an insect is collected it should be placed in a special killing bottle to kill it quickly, thus preventing damage to the specimen. A safe and effective killing bottle is made by placing about one inch of small pieces of rubber from rubber bands, inner tubes, etc., in the bottom of a glass jar. Saturate the rubber with carbon tetrachloride, then place a heavy cardboard disk over the rubber to prevent small insects from falling into the pieces of rubber. The disk should fit snugly to the sides of the jar. Place some bits of tissue paper in the jar to prevent live insects from damaging the ones already killed. Put the screw lid on tight and the bottle is ready for use in about two hours. As the bottle is used the carbon tetrachloride will lose its strength, and more must be added from time to time.

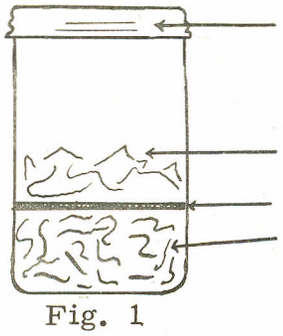
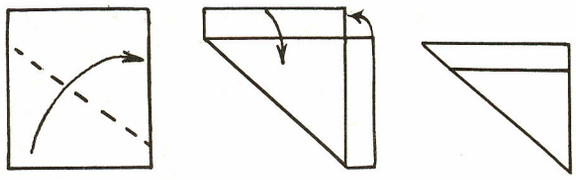


Fig. 1

Insects should be removed from the killing bottle when it is filled, or at the end of each field trip. They should be pinned as soon as possible. If they must be stored for any length of time before pinning, place them in paper triangles or pill boxes. Label each triangle or pill box so that date and place of collecting is not lost.



Paper Triangle Drawing

Fig. 2

Dried insects must be relaxed before pinning. To relax dried insects, place a bit of cotton or blotting paper in the bottom of a pint fruit jar. Moisten the cotton or blotting paper with water, and add a drop or two of carbolic acid to prevent molding. Cover with a cardboard or blotting disk, then place the insect specimens in this jar for two days, or until they have become relaxed so that the legs, wings and other parts may be moved without breaking.

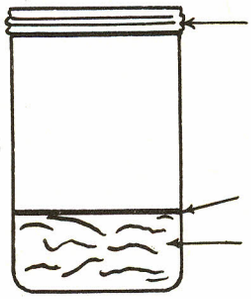
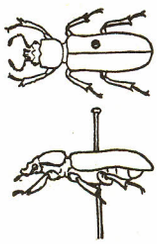


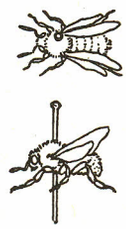
Fig. 3

Pinning Insects. Most insects are pinned directly through the body, using a special insect pin or a steel common pin. If common pins are used, be certain that they are stainless steel. Otherwise rust will destroy the specimen. Insect pins may be purchased from many supply houses. For information about them, ask your county agent. Very small insects should be glued to small cardboard triangles which may be obtained from the county agent without charge.

Insects should be pinned as illustrated below.

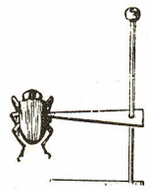


Beetles
Fig. 4

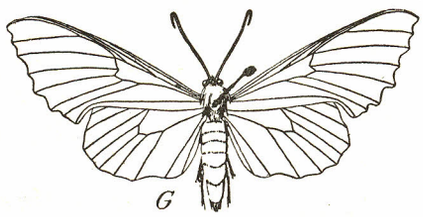


Flies & bees
Fig. 5

Bugs
Fig. 6

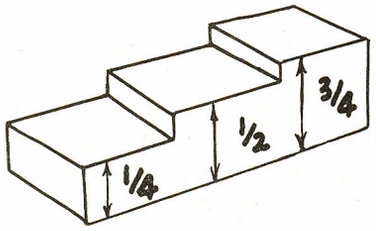


On triangles
Fig. 7



Butterflies and moths
Fig. 8

The distance from the head of the pin to the body of the insect should be the same on all specimens. This may be done with a pinning block. First place the pin through the body of the insect to within 1/4 inch of the head of the pin. Place the head of the pin in the hole of the shortest section of the pinning block to measure the distance from the pin head. The other 1/4" sections are for label spacing.



Pinning block
Fig. 9

Collecting soft bodied insects. Soft bodied insects and caterpillars should be preserved in small bottles of alcohol. They may be placed in the small bottles at the time of collecting. Corks should be dipped in hot paraffin to seal them. A label should be placed in the bottle with the insects showing the date and place of collecting and the collector's name.

Labeling insects. Two labels should be placed on the pin below the specimen giving the location, date and collector on the upper label, and the identification of the insect, the plant it was found on, and other interesting information on the lower label. Labels should be about 1" long and 3/8" wide. They should be of hard-finished white paper, and lettered with india ink.

Labels.

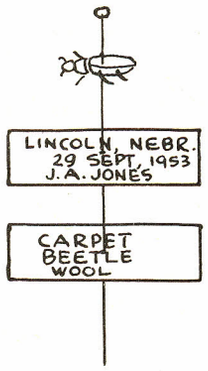


Fig. 10

Spreading boards. Spreading boards are used to spread the wings of butterflies and moths before they dry. All butterflies and moths are pinned with wings spread. Spreading boards may be made from orange or apple crates as in the diagram.

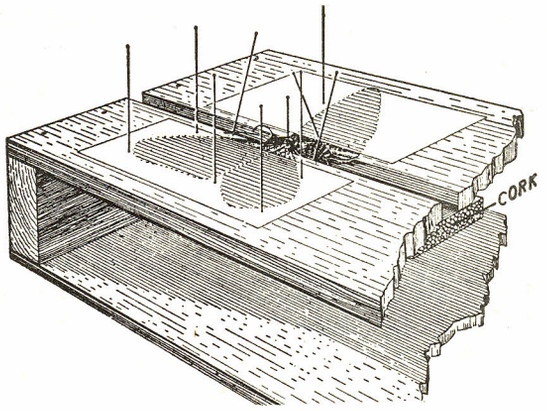


Fig. 11

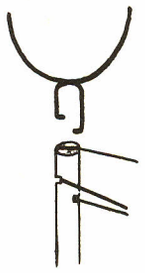
The body of the butterfly or moth is placed in the slot between the two boards, the wings spread and held in place with a strip of cardboard pinned to the surface of the spreading board. They should remain on the board about three days to allow the wings to set. Larger specimens may require a longer time to dry. The pin should be placed through the insect before it is spread. If pinned after drying, the insect will break.

Collecting nets. A sweep net is used to collect insects from grass, trees, and shrubs, by quickly swinging the net over the plants. It should be sturdy as it is subjected to more wear than the regular net. The handle should be about three feet long, and may be cut from an old broom handle. Cut a groove across one end of the handle, then bore a hole one-half inch deep on one side of the handle three inches from the end, and a second hole one-half inch deep on the opposite side four inches from the end.

With a very heavy wire (1/8 inch in diameter), approximately four feet long, bend a loop and attach it to the handle as shown in the diagram. Bind the ends of the wire tightly to the handle with fine wire or heavy twine.

Make a bag from unbleached muslin to fit the wire loop, about one foot in diameter and two feet long, tapering to a point. The bag may be placed on the wire loop before it is attached to the handle, or it may be sewn to the loop after it is attached to the handle. It is advisable to double the muslin around the loop, which will make the net last much longer.

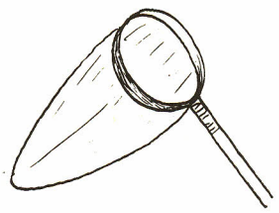
An old tennis racquet with a muslin bag attached to the hoop makes a fine sweep net.



Groove in end of handle

Holes in handle

Fig. 11A



Bag on hoop.

Fig. 12

Aerial nets for collecting butterflies, moths, etc., are made like the sweep net, with a 4 foot handle, and using mosquito bar or curtain material for the net.

Collection Box. A cigar box can be made into a good collection box by fitting a sheet of celotex, cork, or soft corrugated cardboard in the bottom and covering with white paper. However, a better collection box with glass top may be made at a very small cost.

The glass top box should be 12 x 18 x 3 1/2 inches. A cork, or celotex lined bottom with white glazed paper cover is desirable. The grooves should be 1/4" deep and only wide enough for the glass to fit snugly. The following diagram shows details of the approved collection box.

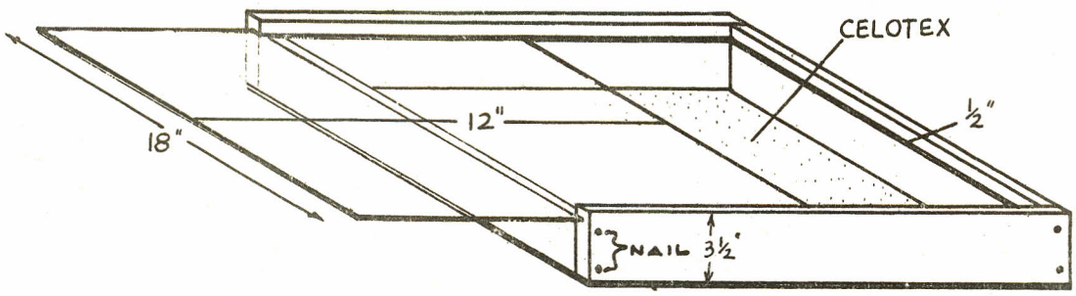


Fig. 13

Placing Insects in Boxes. Only pinned and labeled specimens should be placed in the box. Order names should be labeled on a strip of paper 2" long and 1/2" wide and pinned to the bottom of the box. All specimens in one order should be pinned in neat rows with the order label below and in the center of the row.

Preventing Museum Pests. Small beetles (dermestids), called museum pests, destroy unprotected collections by eating the dried insects. To prevent damage by these pests a small container of para dichlorobenzene (moth crystals), or moth balls should be kept in the box at all times. Moth balls can be prepared by heating a common pin red hot, then forcing it into the moth ball. Pin the moth ball into the bottom of the box. This will prevent the moth balls from rolling about and breaking specimens. Large boxes should have two or three moth balls pinned in them.

How to Identify Insects. Insects belong to a group of animals called the arthropods (jointed legs). Spiders, ticks, scorpions, millipeds (thousand legged worms), and centipedes (hundred legged worms) also belong to this group. The true insect has six legs, antennae (feelers), a body divided into three regions, and most adult insects have wings. None of the other members of the arthropods have this combination of characters. The insects are divided into orders which contain many different kinds of insects that have the same general characteristics. The most important orders are:

Orthoptera: (Grasshoppers, katydids, crickets, cockroaches, preying mantids, and walking sticks.) They have chewing mouthparts and usually four wings. The top wings are narrow and leathery, the under wings are longer, thin and fold like a fan under the top ones.

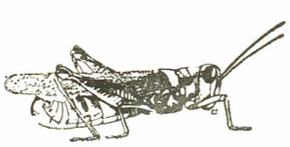


Fig. 14

Odonata: (Dragonflies and damsel flies. Sometimes they are called "snake doctors.") They live the early part of their life in water, and when fully grown have four wings which a are narrow, long and have many veins. Dragonflies leave their wings spread when resting, damsel flies generally fold theirs over the back as butterflies do.

Fig. 15

Neuroptera: (Lacewings and ant lions.) They have four wings, long, narrow and with many veins. The young lacewings feed upon plant lice, ant lions feed on ants and other small insects that fall into their cone-like pit in the ground. They are often called "doodle-bugs".

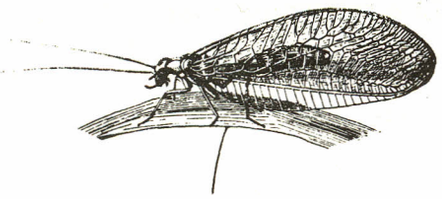


Fig. 16

Insect Life Histories: (Metamorphosis) Insect development from egg to adult is called metamorphosis, a word meaning "change in form". There are three general types of metamorphosis; no metamorphosis, incomplete metamorphosis, and complete metamorphosis.

No Metamorphosis. Lower insects such as silver fish grow only in size. There is no change in general form after hatching from the egg. Since no form change occurs they have no metamorphosis, developing only in size.

Incomplete metamorphosis. This term indicates there is a change in form which is not complete. Many of our common insects develop in this manner. Grasshoppers, stink bugs, plant lice, and dragonflies develop by incomplete metamorphosis. Hatching from the egg, the young insect resembles the parent in general form but does not have wings. Each time the skin is shed the wingspads are a little larger, At the time of the last shedding of the skin (molt), the fully developed wings are present, and the insect has reached the adult stage. Life stages are: egg, nymph, and adult. The food is the same for nymphs and adults.

Complete Metamorphosis. This type of development has a complete change in form from the young insect to the adult. Butterflies, moths and beetles develop in this manner. The egg hatches into a larva which is the growing stage. The insect sheds its skin (molts) as it grows. When the last molt occurs the larva forms a pupa stage, in which it changes to the adult. Life stages are: egg, larva, pupa, and adult. The food habits of the larvae and adults may or may not differ. Butterflies and moths have different food habits, the larvae generally feeding upon living plants, the adults feeding upon nectar, fruit juices, or not feeding at all. Most beetles differ in larva and adult foods, but some have the same habits. An example is the ground beetle which is predacious in both larval and adult stages.

All insects shed their skins as they grow. The skin is dead tissue which cannot grow as does the body, so is discarded when it becomes too small. After insects reach the adult (winged stage in most insects) growth has been completed, so they do not increase in size.

Mallophaga: (Chicken lice and red cattle lice.) They are the chewing lice that live on birds and animals. They feed on skin scales, and are very annoying to livestock. They do not have wings.

Fig. 17

Anoplura: (Hog lice and blue cattle lice.) The sucking lice of animals, they do not attack birds. They look much like chewing lice, but have a narrow head and flatter body. These lice have sucking mouthparts to suck blood from their hosts.

Fig. 18

Siphonaptera: (Fleas) They suck blood of many different animals. At times the human flea is a dreadful nuisance in the home. Some fleas spread plague and typhus fever of man, and from rodent to man or other rodents.

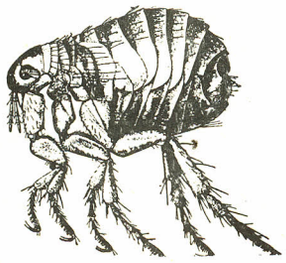


Fig. 19

Hemiptera: (Stink bugs, chinch bugs, lygus bugs, squash bugs, etc.) They have four wings in the adult stage. The top pair are thick and leathery at the base near the head, and thin, usually with veins at the tips. These insects have sucking mouthparts. Some live in water. The bedbug belongs to this order.

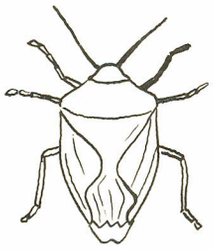


Fig. 20

Homoptera: (Leafhoppers, cicadas, treehoppers, plant lice, and scales.) Many do not have wings (such as most plant lice and scales). Leafhoppers and cicadas have four wings that are held roof-like over the body. The top wings may be transparent in cicadas and colored in leafhoppers and treehoppers. They all have sucking mouthparts.

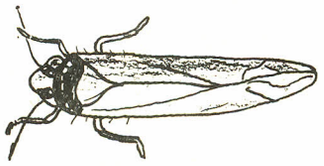


Fig. 21

Coleoptera: (Blister beetles, potato beetles, june beetles, fireflies, weevils, whirligig beetles, and hundreds of other beetles). All kinds have four wings, the top pair are hard like a shield, the under pair are thin and fold up. The thin pair are used for flying. They have chewing mouthparts in both adults and larvae. The beetles contain the greatest number of different kinds, the insect orders.

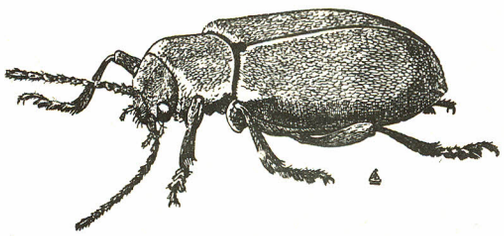


Fig. 22

Lepidoptera: (Moths and butterflies) They have four wings, although there are a few exceptions like the female cankerworm. The wings of butterflies are covered with very small scales, the wings of moths with very fine hair-like scales. They have siphoning (tube-like) mouthparts in the adult stage, and chewing mouthparts in the caterpillar stage. Butterflies rest with wings folded over their backs, moths rest with wings spread flat or folded flat on their backs.

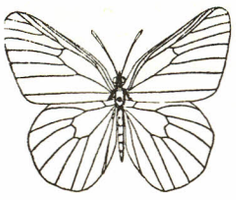


Fig. 23

Diptera: (Flies) Flies have only two wings, the second pair having been replaced by halteres (short stalks, usually with a small knob on the end). The flies make up a large order, and a very important one. Many kinds spread disease (mosquitoes, house flies, etc.) Many are parasites on cattle (horn and stable flies). Some are parasites in animals (warble flies, and bot flies). The immature fly is a maggot so commonly observed in dead animals, rotten vegetation and manure.

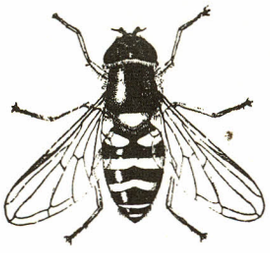


Fig. 24

Isoptera: (Termites) Termites, sometimes called white ants, are among the most destructive insects to wood and wood products. They live in a colony much like ants, but are not closely related to the ants. Several castes are present in a colony; the workers, soldiers, nurses, kings and queens. Kings and queens are reproductive forms which develop wings to swarm from colonies to establish additional colonies. Kings and queens are brown in color with four long wings at swarming time. The other castes do not have wings, and are white in color.

Fig. 25

Collembola: (Springtails) Springtails are wingless insects without metamorphosis. They are very small, generally less than 1/16 inch long. They jump with a spring-like mechanism on the underside of the abdomen. They occur generally under bark of logs, damp places, in leaf mold, and moist places. Some kinds are found on the surface of snow and are called snow fleas, others are found on surfaces of water. Generally they are of no economic importance.

Fig. 26

Thysanura: (Silverfish) Like the collembola these insects are wingless and develop without metamorphosis. They are small, silvery colored insects with three long bristles at the end of the body and long antennae. They are often found in houses, especially in dark corners and basements, and often are observed in bath tubs where they fall and cannot climb out. They feed on starchy materials, therefore are injurious to books, wallpaper and certain fabrics.

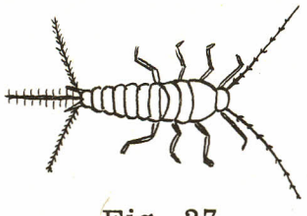


Fig. 27

Corrodentia: (Book lice) Book lice are the very small wingless, insects seen crawling on the pages of old books and papers. They may damage books by feeding on glue and paper. They also feed on dried plant materials, cereals, and other dried plant and animal products. Being so small they are not often of great economic importance.

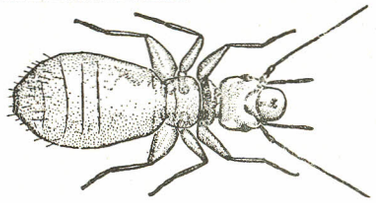


Fig. 28

Thysanoptera: (Thrips) Thrips are very small insects which have two pairs of slender wings which are edged with many long hairs. The mouth parts are rasping. They rasp the surface of plants, sucking up the juices that seep out. They develop by incomplete metamorphosis. Several species are destructive to commercial crops.

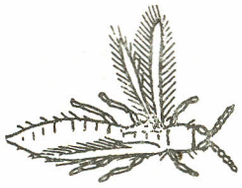


Fig. 29

Plecoptera: (Stoneflies) The adults of this order frequent areas of vegetation near streams. Females lay eggs in water. Several thousand eggs may be laid by one female during her life time. The immature stages live under stones, leaves, and other objects in water where they feed on other water organisms and plant life. The adults do little if any feeding. The nymphs serve as food to fish, and are important in this respect. Metamorphosis is incomplete.

Fig. 30

Ephemeroptera: (Mayflies) Adult mayflies have two or three long tail-like filaments extending from the abdomen. There are four net-like wings; the hind pair is much smaller than the first pair. The young develop in muddy water feeding on vegetable material. Adults generally emerge from the nymph stage in great numbers, swarming near the water, and are attracted to lights. Adults do not eat and soon die after eggs are laid in water. Both adults and nymphs are food for many kinds of water animals and birds.

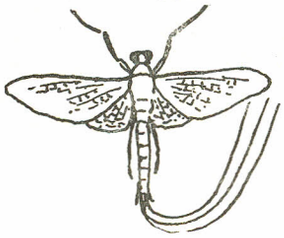


Fig. 31

Mecoptera: (Scorpionflies) Scorpionflies have a long-faced head, two pairs of long, slender wings, long antennae and legs. Males have an enlarged tip on the abdomen curling upward much like scorpions. Larvae develop in the feeding on other dead insects, decaying vegetable matter and probably other vegetative foods. Metamorphosis is complete. They do not sting.

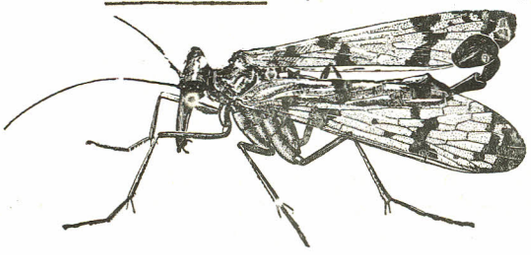


Fig. 32

Tricoptera: (Caddisflies) Two pairs of wings are held roof-like over the body, usually hairy or scaly like a moth's wings. They resemble moths very much, and are probably closely related. Eggs are deposited in water, the young making cases which cling to the undersides of stones or on stems of water plants in streams. Some larvae spin cocoon-like cases, weaving sand or other materials into the case. The larvae are food for fish, and feed on other water insect larvae and organic material.

Fig. 33

Dermaptera: (Earwigs) Earwigs have short fore wings that are hard like beetle wings. The hind wings fold fan-like under the hard fore wings. The tail ends in a pincer-like appendage. Most species are not strong fliers; some do not fly. Metamorphosis is incomplete. The food of the nymph and adult is, for the most part, dead animal and vegetable material. They are more often found flying to lights as they do not normally move about in the day time.

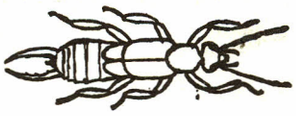


Fig. 34

Insect Relatives

Spiders; Spiders belong to the class Arachnida, and the order Araneida. They are not insects, but are closely related to the insects. Spiders have eight legs, never have wings, never have antennae (feelers), and none are of economic importance as damagers of crops. Most spiders are harmless to man, and are beneficial because of the insects they eat. Only one kind of spider is very poisonous--the black widow. The spider's ability to spin silk is one of its outstanding characteristics. The male spider is very small compared to the female. There are about 22,000 different kinds.

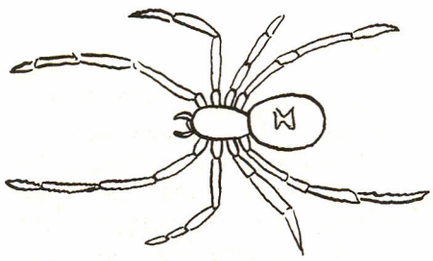


Fig. 35

Mites and Ticks: Mites and ticks belong to the class Arachnida, and the order Acarina. They are more closely related to the spiders than to insects. Ticks and most mites have eight legs when fully grown. The body is all one region, and mites, especially, are very small. Many species are microscopic in size. About the only difference between mites and ticks is in size, ticks being much larger. Some mites (spider mites) injure plants, many are parasites of animals and man, and many spread diseases of both animals and man. Rocky mountain spotted fever is spread by a tick as is rabbit fever. Several mites spread tropical diseases.

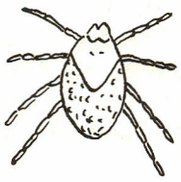


Fig. 36

Scorpions: Scorpions belong to the class Arachnida, Order Scorpionida. They are also more closely related to spiders than insects. Scorpions are rarely observed in Nebraska, and then only in the southern sections. They are common in the southwestern part of the United States. They are widely known because of their sting. The stinger is located on the end of the long, slender tail. They have eight walking legs, and the pedipalps are developed into a pair of pincers used to grasp their prey. The pincers are not legs. The sting is used to paralyze their prey. They inflict a very painful sting, although not generally dangerous. Species occur in the southwest that do have a very powerful poison.

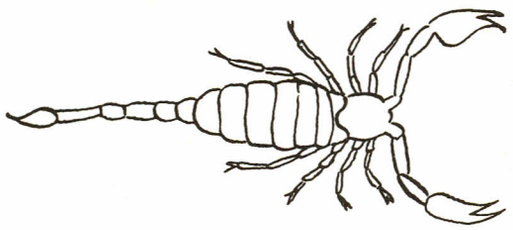


Fig. 37

Granddaddy Long-legs. These belong to the order Phalangida of the class Arachnida, so are also closely related to spiders. They are harmless to humans and animals. The food is probably small soft-bodied insects, and possibly some plant fruits. The legs are very long, and easily separate from the body, probably as a means of defense. If an enemy grasps one leg, the granddaddy long-legs escapes with one leg missing. They have a disagreeable odor. They are commonly observed in corn fields, and heavily wooded sections.

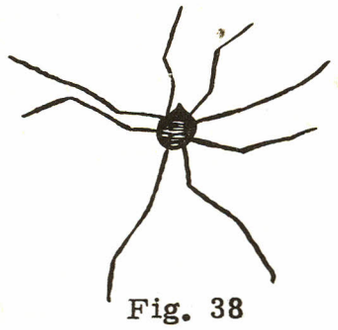


Fig. 38

Sow Bugs and Pill Bugs. These two belong to the class Crustacea, as do the crayfish, crabs, and other aquatic forms. Sow bugs and pill bugs resemble each other very much, but the pill bugs roll up into a ball when molested. They are the two crustaceans most often confused with insects. They are found under boards, decaying straw, in greenhouses and other damp places. Generally they are not injurious to plants, but sometimes they damage greenhouse plants by feeding on the roots. Their food consists mainly of decaying organic plant material.

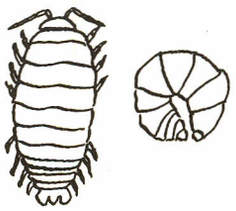


Fig. 39

Centipedes. More often called hundred legged worms, centipedes belong to the class Chilopoda, and are perhaps the closest relatives to insects. They have antennae, but never have wings. The body is divided into segments with one pair of legs to each segment. The name means centi-one hundred, pedes-feet, although they have fewer than the name indicates. Poison jaws are located below the head, but none in Nebraska are dangerous. The food is comprised of insects and other small related creatures.

Fig. 40

Millipedes. More often called thousand legged worms, millipedes, class diplopoda, have two pairs of legs per segment. They do not have poison jaws, and generally feed on decaying organic matter. A few species may feed on plant roots.

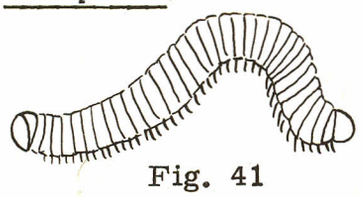


Fig. 41