4-H VOLUNTEER INFORMATION SERIES

Nebraska 4-H Youth Development

Club Activity Idea: When Bugs Fly!

Outcome Area: _X_ SET __ Healthy Lifestyles __ Life Skills __ Career Development

Curriculum Area: Entomology

Specific Project (s): *Entomology 1; Entomology 2; Entomology 3*

Age Level: 15 -18 year olds

Time Involved: Preparation time: Activity time: 3 - 45 minute sessions

Description of Activity:
Participants will be given materials to create an insect with wings. Students may work in groups and will be assigned to different types of insects. Styrofoam, clothespins, light weight wire, various weights of paper (construction paper, tissue paper, parchment, vellum, card stock and copy paper) and pipe cleaners will be used to create their insect. The insect that each group is assigned will determine the body type and wing style. The weight of paper that is needed for the wings will be determined by body and wing style. Students will be supplied with a wide variety of tools such as scissors, tape, paper clips and glue to finish the construction of their insect.

Learning Objectives:
Students will:

1. recognize the differences in insects' wings.
2. develop an understanding for why an insect has a specific type of wings.
3. be able to identify insects by the type of wings they have.
4. determine the primary functions of an insect's wings.
5. create an appropriate set of wings for assigned insect.

Scientific goals:

1. To determine which type of wing allows insects to travel the greatest distance.
2. To determine the relationship between the size of the insect's body and its wings.
3. To determine the relationship between the type of wing an insect has and its function.

Materials Needed:
Various types of paper for wings (tissue paper, vellum, wax paper, parchment, construction paper or copy paper). Other supplies: styrofoam, clothespins, tape, glue, paperclips, wire, yarn, pipe cleaners, pins, and references for insect structure including websites and textbooks.

Useful Resources that will provide excellent information are:

1. *Peterson's Field Guide – Insects*
2. *The Study of Insects*
3. *The Science of Entomology*

Overview: Insects are the only invertebrates that can fly. Their wings are simply extensions of their exoskeleton and are only completely functional in the adult stage of their life cycle. Generally, insects have two pairs of wings. One located on their mid-section, mesothorax, and one on their hind-section, metathorax. Insects' wings can serve as a protective covering, thermal collectors, gyroscopic stabilizers, and sound producers as well as giving them the ability to fly. The type of wings an insect has can be very different. They can be membranous, parchment-like, sclerotized, fringed with long hairs and even covered with scales.

Vocabulary: exoskeleton, mesothorax, metathorax, sclerotized, gyroscopic stabilizer, elytra, hemelytra, tegmina, Coleoptera, Hemiptera, Orthoptera, Lepidoptera

Background

Some insects use their wings for traveling, some use them for protection, some use them to produce sound and some use them to distinguish between species. We are able to use insects' wings to identify them. Insects have different wing types. When you look at an insect's wing, you are able to see veins; the lines and ridges across the wing. The area between the veins is known as the cells. The types of wing characteristics that we will be using in this activity are: elytra, hemelytra, tegmina and scaly wings.

Elytra are the hard sclerotized front wings that protect the membranous hind wings of a Coleoptera (beetle). Beetle wings, when folded over their backs, can be brightly colored. Like most insects, beetles have two pairs of wings. However, the primary function of beetles' wings is not flying; it is protection.

Hemiptera (stink bugs) have front wings that are parchment-like at the base and membranous at the tip. The hind wing is completely membranous. When you observe a stink bug, it appears as though it has a hard outer covering. As with beetles, stink bugs' wings function as protection before they are used for flying. While both beetles and stink bugs can fly, they are usually found crawling on the ground.

The wings of Orthoptera, including grasshoppers and praying mantis, are tegmina. This type of wing is totally parchment-like and has many veins running across it in different directions. These insects use their wings to fly more frequently than beetles or stink bugs; there is little or no protective value to this kind of wing.

Lepidoptera (butterflies) use their wings on a continuous basis. Butterflies fly nearly everywhere they go. Both their front and hind wings are covered with flattened setae or scales. If you were to touch a butterfly's wings, your fingers will often turn colors; these are the scales that you have removed from their wings by touching them.

The type of wings that an insect has usually determines the nature of flight that the insect is capable of; some insects are able to hover in place and even fly backwards. Insects that use their wings primarily for flight tend to have long slender wings. Insects have the ability to beat their wings numerous times per second. Most insects are also able to travel large distances compared to their body size. Mosquitoes are able to beat their wings up to 1,045 beats per second, while larger insects like dragonflies beat their wings approximately 38 times per second. The same species of dragonfly is able to travel at 15.5 mph.

It is necessary for insects to be able to fly great distances and often quickly to escape from danger. Many insects, who use flight as their primary means of transportation, locate food and mates by this method. In some cases they are also searching out new habitats.

K-W-L:

K- recall what students **KNOW** about the subject.

W- determine what students **WANT** to learn.
L- identify what students have **LEARNED.**

K Component:

1. Why would it be necessary for insects to fly?
2. Does the type of wings that an insect has have an effect on the habitat that it selects?
3. Can insects travel great distances?
4. Does the size of the wings or the speed with which they move be more important to insects?

W Component:

1. What do we want to learn about the structure of insects that will illustrate how complex their structure and capabilities are?
2. What do we want to learn about insect wings that will help us to identify them?
3. What do we want to learn about insect wings' structures being similar to human finger prints in terms of identification?
4. What are the goals of this activity?

Hypothesis:
Insects with _____wings will be able to travel greater distances at a more rapid rate of speed, allowing them to have more diverse habitats.

Experimental Design:
Materials: Wing construction: Match the wing type to the weight of paper or combination of paper types (tissue paper, vellum, wax paper, parchment, construction paper or copy paper) that you feel is appropriate to simulate the insect's wings. Styrofoam, clothespins or a combination may be used to create the insect's body. Students will be given numerous other supplies such as: tape, glue, paperclips, wire, yarn, pipe cleaners and pins to assemble their insect. Having an idea of the general structure of a beetle, stink bug, grasshopper, dragonfly and butterflies will be beneficial.

Procedure:
Step #1: *Research insect's wing type.* Before designing the wings that you will be using for your insect, it will be necessary to know what structure and function the wings require. The students will be put into groups and then assigned to an insect. Use the resources available, photos printed from the internet or photos found in insect textbooks and insect identification materials, to understand the structure of the wings of the insect being used in this activity.

Step #2: *Construct insects.* After completing enough research to understand the type of wings that each group of students will need to construct, they can use any of the materials provided: styrofoam, clothespins, light weight wire, pipe cleaners, and various weights of paper (construction paper, tissue paper, parchment, vellum, card stock and copy paper). When constructing their insects, there are some variables that should be considered that can affect an insect's ability to fly.

Variables:
1. <u>Wings and body structure.</u>
    a. Each insect has a different type of body. Students will want to closely match the materials used for the insect's wings and body to that of the same insect found in nature, being aware of the wings' primary function to that particular insect, i.e. for beetles the wings are fundamentally used for protection and for a butterfly their wings are primarily for flight.
    b. Insects have different types of wings, tegmina, elytra, and hemelytra.
    c. Students may add some variation in the structure of the insect's body and wing structure, but will need to keep their adaptations realistic.

2. Wind speed.
    a. The wind can have a large affect on an insect's ability to travel. Taking the aerodynamics of an insect's wings into consideration could be beneficial.
3. Predator protection.
    a. Some insects' wings protect them from predators. Make sure to take the type of predators you might want to be protecting your insect from into consideration.

Step #3. *Test insect flight.* Once the insects are constructed, the students will need to test their ability to fly. Have each group of students practice flying their insects, much like you would a paper airplane, making observations as to how well they fly and what might be affecting their flight.

Step #4. *Test function of the insect's wings.* The primary function of an insect's wings is not always flight. Each group of students will need to test the durability of the insect's wings. Use a spray bottle to determine the effect that rain might have and drop toothpicks to determine if the wings provide the insect with needed protection.

Data Collection:
Step #5. *Observe flight and record data.* While students are flying their insects, have them record the distance that their insect travels during each flight. Students will need to have 5 trial flights of their insect. Students can calculate the average distance that the insect traveled.

Step #6. *Share observations.* After students have completed their trials and calculated their average distances traveled, have students share information about their insects. What conclusions can the students develop after hearing what type of wings allowed insects to travel the greatest distance and which wings provided the greatest amount of protection.

Questions for further discussion
L – identify what students have **LEARNED.**

1. What variables did you take into consideration when constructing your insects?
2. What type of wings did you find produced the longest flight?
3. What type of wings provided the greatest amount of protection to the insect?
4. What other variables would have affected your insect's ability to fly?

Lesson Developed by: Kerry John, University of Nebraska-Lincoln Extension

References:
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http://www.si.edu/Encyclopedia_SI/nmnh/buginfo/insflight.htm
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http://www.cals.ncsu.edu/course/ent425/tutorial/wings.html
Insect Flight
http://en.wikipedia.org/wiki/Insect_flight