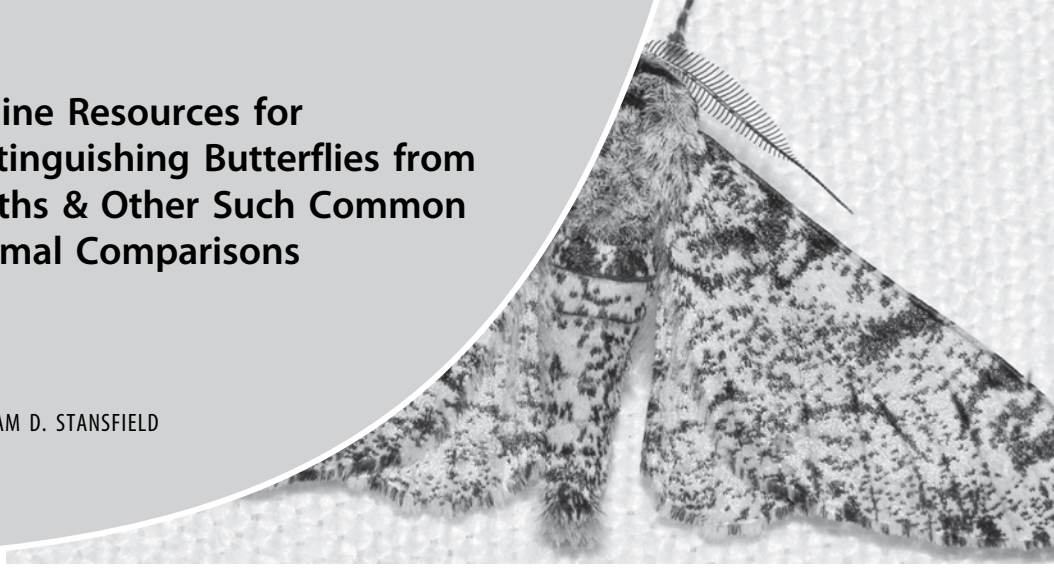
TIPS, TRICKS & TECHNIQUES

Online Resources for Distinguishing Butterflies from Moths & Other Such Common Animal Comparisons



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Abstract

When biology students are in the field or in the laboratory observing common animals or pictures thereof, we would like them to be able to identify some of the differences between, say, a frog and a toad, or a hare and a rabbit. These differences may be anatomical, physiological, behavioral, reproductive, or developmental. This article suggests a way for students at the high school or higher educational levels to learn how to use the Internet to distinguish between some common or well-known animal pairs (such as butterflies and moths). A starter list of online sources of information is provided for distinguishing between 16 such animal pairs.

Key Words: *Ecological and evolutionary principles; independent online learning; industrial melanism; mimicry; species characteristics; sexual dimorphism.*

Biology curricula are often so packed with broad subjects such as genomics, ecology, and evolution that students may leave their high school biology class without understanding the differences between common everyday organisms. Here, I focus on the differences between butterflies and moths as a model for teachers and students to do independent online research for other common animal pairs of their own interest, as a consequence of having their curiosity aroused. Curiosity about the natural world is one of the prime motivators for people to continue to learn about scientific subjects throughout their life or to become scientists themselves. A starter list of online sources of information is provided at the end of this article for distinguishing between 16 such animal pairs.

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○ What's the Difference between a Butterfly & a Moth?

Students can obtain a copy of Table 1 from the teacher or from the Internet for independent study before being asked questions in class discussion or on an exam. Students should be encouraged to go online at the website from which Table 1 was derived and read the detailed descriptions for some of the differences cited in Table 1. There are no details given for mating selection, feeding behavior, or sound detection; body temperature regulation is discussed under the heading "Differences in body structure." A discussion of "wing coupling mechanisms" is given, but this subject is not listed in the online table. It should be noted in the online text that some of the criteria for distinguishing moths from butterflies are "exceptions to the rule."

After students have been given an opportunity to study Table 1, teachers may wish to probe for deeper understanding by asking: "Why would moths benefit from detecting sound any more than butterflies would?" (Does knowledge of the activity period of moths help answer that question?) "What animal preys on moths at night?" (Answer: bats.) Students should thus come to understand how a moth's hearing can detect the ultrasound echolocation of bats and allow the moth to take evasive action. This sense of hearing is an adaptation to the moth's environment that increases its chance of survival and reproduction, a basic concept of evolutionary biology.

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Table 1. A comparison chart of some differences between butterflies and moths (from http://www.diffen.com/difference/Butterfly_vs_Moth).

Trait	Butterfly	Moth
Mate selection	Use sight to select mates	Use scent to select mates
Feeding behavior	All species have a prominentproboscis or feeding tube	Silkworm moth has very smallproboscis and adults do not feed
Sound detection	Cannot detect sound	Have ears
Antennae	Long and thin; usually swollen at the end	Variable shape; seldom with swollen tips
Resting posture	Usually with wings closed	Wings usually open
Body temperature regulation	Uses the sun to warm up	Moves wings to warm up
Pupa	Makes a chrysalis hanging from a branch or other support	Makes a cocoon undergroundor on the ground
Color	Usually bright	Usually less bright than butterflies
Activity period	Active mostly during the day	Active mostly at night

○ Additional Comments to Table 1 Descriptions

The entries for "Antennae" and "Feeding behavior" in Table 1 have replaced those in the online table to avoid misleading and inaccurate statements.

Antennae. The antennae of moths may be hair-like or thread-like (filiform), bristle-like (setaceous), or feather-like (plumose). The antennae of butterflies are only filiform, often knobbed at the tip. The antennae of moths seldom have swollen tips. The antennae of male moths may be enlarged (compared to those of females) to detect the sex odors (pheromones) emitted by females of the same species. This phenomenon is known as "sexual dimorphism."

Feeding behavior. Both adult butterflies and moths have a tube-like proboscis suited for ingesting liquids. The proboscises of butterflies and moths are usually long and coiled along the sagittal plane, dividing the body into right and left halves. The mouth parts of the adult giant silkworm moth are greatly reduced, and the adults do not feed. They survive off of fat stored during the larval stage. However, the proboscises of many species of hawk moths can be as long as the body or longer. Thus, the description of moth feeding behavior in the table cannot be used to distinguish all moths from all butterflies.

Pupa. Most moth larvae (caterpillars) spin a cocoon of silk threads that envelop the pupa. Royal moths pupate in the ground without forming a cocoon. The larvae of most butterflies do not spin a cocoon blanket around the naked pupa (called a "chrysalis"). Skippers are a group of small, stout-bodied butterflies that pupate inside a chrysalis of leaves fastened together with silk.

Activity period. Some sphinx or hawk moths are day fliers; some moths are active at dusk or twilight.

Color and mate selection. Many adult moths bear distinctive colors and patterns that would not be helpful in selecting mates of the same species in the dark of night, but might be useful for those moths that are active at dusk or twilight.

Terminology. Here are some of the terms used in the online article that may be new for many students: *frenulum*, *jugum*, *crepuscular*, *diurnal*, *bipectinate*.

○ Activity Assessment

Teachers may wish to assign each student, or a small group of students, to choose one pair of animals, from the list of URLs below, and report their findings to the class. Included in each report should be a comparison chart with at least two major differences between the selected organisms, comparable to that of the 2 × 9 format in Table 1. Alternatively, students might be allowed, with the teacher's permission, to choose a pair of animals that are not in the list of URLs and possess differences that are unlikely to be well defined in the minds of many people.

○ Question & Answer Assessment

As a result of studying the information presented online and here, students should become aware of the differences between relatively closely related butterflies and moths, but what about the differences between these species and other, more distantly related groups of organisms? The following questions can be used to test students' understanding of where butterflies and moths fit in a hierarchy of groups within groups (taxonomy).

Q1	**What adult trait characterizes the insect order Lepidoptera, to which butterflies and moths belong?**
A1	Two pairs of wings (forewings and hindwings) with overlapping scales.
Q2	**What traits characterize the class Insecta?**

A2	Invertebrate with three adult body segments (head, thorax, abdomen); six thoracic legs.
Q3	**What trait places all insects into two developmental groups?**
A3	(1) Those with complete metamorphosis (egg → larva → pupa → adult);
	(2) Those with incomplete (simple) metamorphosis (egg → instars [nymphs] → adult).
Q4	**What phylum-level trait characterizes insects, spiders, scorpions, ticks, mites, crustaceans, millipedes, and centipedes?**
A4	Invertebrates with jointed appendages (phylum Arthropoda).
Q5	**What three traits collectively define all animals?**
A5	Non-photosynthesizing (heterotrophic) organisms with nucleated cells (eukaryotes) but without cell walls.

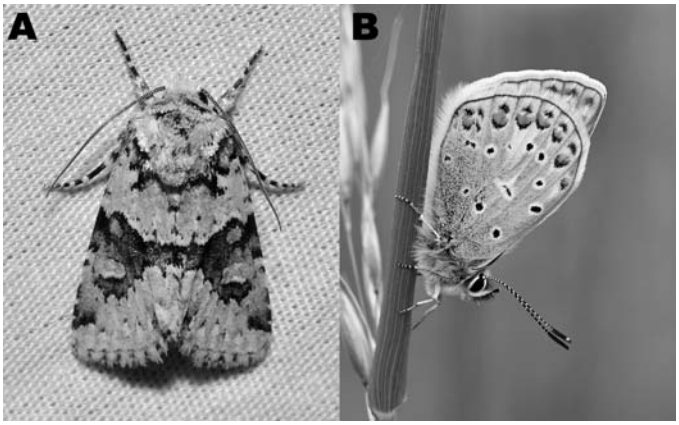

Figure 1. Photographs of two insects at rest to be identified by the viewer. (**A**) http://mothphotographersgroup.msstate.edu/WalkThroughIndex.shtml. (**B**) http://all-free-download.com/free-photos/download/the_nature_of_the_insect_butterfly_215420.html.

○ Identification Assessment

Identify the two animal photos in Figure 1 as being either butterfly or moth. Give at least one reason for each of your choices.

Answers: Figure 1A: Moth antennae without swollen tips. Figure 1B: Butterfly has slender antennae with enlarged tips. At rest, moth wings are usually open. At rest, butterfly wings are usually closed.

○ Enrichment Activity

Read online about two evolution concepts (mimicry: Figure 2; industrial melanism: Figure 3) involving butterflies and moths, respectively.

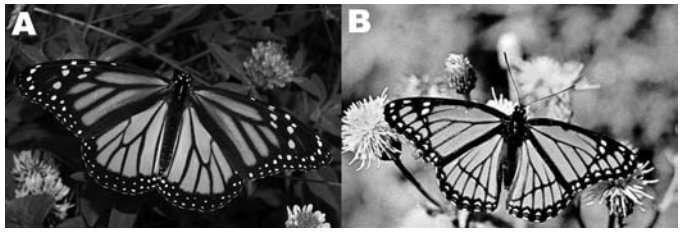

Figure 2. (**A**) Monarch butterfly (courtesy of Kenneth Dwain Harrelson; https://commons.wikimedia.org/wiki/File:Monarch_In_May.jpg). (**B**) Viceroy butterfly (http://blogs.britannica.com/2011/05/mutual-mimicry-viceroy-monarch/).

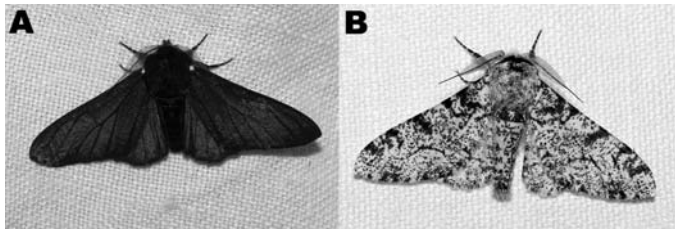

Figure 3. Peppered moths: (**A**) melanic (dark) form and (**B**) light form (available at http://en.wikipedia.org/wiki/Peppered_moth_evolution).

○ Universal Research Locators

The following list of URLs contains distinguishing characteristics of a few other pairs of animals. Students can use a search engine (e.g., Google) to find information on other animal pairs by entering "difference between *species A* and *species B*" (using the common names of any two species in place of those italics).

http://www.diffen.com/difference/Bee_vs_Wasp
http://www.diffen.com/difference/Hornet_vs_Wasp
http://www.diffen.com/difference/Mouse_vs_Rat
http://www.diffen.com/difference/Alligator_vs_Crocodile
http://www.diffen.com/difference/Hare_vs_Rabbit
http://www.diffen.com/difference/Slug_vs_Snail
http://www.diffen.com/difference/Butterfly_vs_Moth
http://www.loc.gov/rr/scitech/mysteries/butterflymoth.html
http://www.diffen.com/difference/Lion_vs_Tiger
http://www.diffen.com/difference/Dolphin_vs_Porpoise
http://allaboutfrogs.org/weird/general/frogtoad.html
http://oceanservice.noaa.gov/facts/seal-sealion.html
http://animals.howstuffworks.com/snakes/legless-lizard-vs-snake1.htm
http://www.flmnh.ufl.edu/fish/education/questions/raybasics.html (skates vs. rays)
http://www.ncaquariums.com/ask-the-aquarium/what-is-the-difference-between-turtles-terrapins-and tortoises
https://answers.yahoo.com/question/index?qid=20080725085654AABBuhY (locust vs. grasshopper)
http://cesonoma.ucdavis.edu/files/27701.pdf (mole vs. gopher)

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