

Insects have become very specialized in the ways they avoid being eaten by other animals. Read this article and answer the questions that follow.

Surviving, for Better and Worse

by Marc Zabrudoff

¹ Nearly all insects are hunted as food, and not just by other insects. Birds, mammals, lizards, snakes, frogs, toads, and especially spiders all depend on insect meals for their survival.

² Insects, naturally, have developed a few ways to avoid joining any of these companions for dinner. Their principal response to attack is to try to escape. No matter how well-armed or -legged an insect might be, it is always far better to flee than to fight. The need to escape predators was surely at least one of the pressures behind the development of insect wings. Wings enable insects to accomplish several other important tasks, of course, such as finding food, mates, and new territory. But their value as an escape tool is very high.

³ Certain insect bodies have developed other specialized parts for escaping a hungry predator's claws and jaws. These include jumping legs in froghoppers, for example, or "ears" in certain night-flying moths that can hear the echolocating calls of bats. (Echolocation is the sound-wave process some animals use to identify and locate objects.) More generalized features include the flattened body of roaches and bugs that allow them to squeeze into impossibly narrow hiding places.

CHEMICAL WEAPONRY

⁴ A large variety of insects try to avoid predators by making themselves extremely unpleasant to eat. Most children have learned that grasshoppers, for instance, spit "tobacco juice" when threatened. The juice is actually the partly digested food from the insect's crop, and it is not so much spit as vomited. It is as unappealing to some predators as it sounds (though not to all—some predators have no taste). Other insects have similar defenses. Stinkbugs, for example, simply stink. Certain water beetles fire pellets of waste from their rear ends as they swim away from pursuing fish.

⁵ These are all mild forms of chemical warfare. Bombardier beetles go in for a more serious version. These insects get their name from their ability to "bomb" an attacker with a series of gas explosions from their abdomen. A mixture of chemicals inside their body results in the emission of a hot, brownish spray that can burn any predator that gets too near. Other beetles ooze out peppery liquids, some from their legs, others from glands inside their forewings. These substances are often powerful enough to burn human skin.

⁶ Many insects make sure they are not just bad tasting but poisonous. Monarch butterflies, when caterpillars, gorge¹ themselves on the leaves of milkweed plants. A chemical in the leaves guarantees that a predator foolish enough to eat a monarch caterpillar will soon vomit up its meal. If it does not, it will die. Adult butterflies continue to carry the milkweed poison they ate as youngsters.

⁷ Of course, this method of defense does little for the butterfly that has already been eaten. By the time the predator learns its lesson, the butterfly is history. But it does protect other butterflies in the future. And poisonous insects usually try to get their message across before being eaten. Most of them are brightly colored or marked with bold black-bordered stripes.

MIMICRY AND CAMOUFLAGE

⁸ The monarch's poison defense is so effective that another butterfly, the viceroy, uses it also. Unlike the monarch, though, the viceroy cannot eat milkweed. In fact, any predator can munch on a viceroy with no ill effects whatsoever—no vomiting, no dying. However, the viceroy has evolved so that it sports the same orange wings with black lines and white spots that adorn the monarch. Birds that have learned to avoid the poisonous monarch will avoid the non-poisonous viceroy as well.

⁹ This kind of defense is called mimicry, and it is not limited to butterflies. Stinging insects, for example, like bees, are often marked by black and yellow stripes that predators quickly grow wary of. The drone fly has taken advantage of this by evolving a striped body similar to that of a bee. Many predators, seeing the drone fly's black and yellow outfit, simply let it pass. In fact the drone fly is harmless, its weaponry non-existent.

¹⁰ Other insects try not so much to look like something else as to look like nothing at all. They camouflage themselves so that they fade into the background. Stick insects blend in among twigs and bark. Treehoppers look, and often feel, like thorns. Leaf butterflies look convincingly like dead leaves. Some caterpillars look like bird droppings.

¹¹ No matter what defense an insect relies on, the brutal truth is that very few of them will die of old age. Insects are a vast food source for animals of every kind, including the insects themselves. In addition, despite the exquisite² design of the insect body, it is still a small fragile thing when compared with the physical forces of weather. Insects can avoid some of the effects of nature. Most can go into a resting, or hibernating, state as an egg or larva or even as an adult. Ladybugs in California, for example, gather in huge colonies to hibernate in the mountains in winter, then return to the valleys in the spring. While they are resting, each ladybug releases a small amount of a predator-repelling substance. The total volume of it protects them all. Other insects migrate to avoid the cold. Monarch butterflies escape winter by flying south—sometimes as much as 2,000 miles (3,200 km) from Canada to Mexico.

¹² Still, the weather takes its toll, and what the elements do not kill, the predators will. Only a relatively few insect eggs ever hatch. Few of those that do ever make it to adulthood. The odds against an insect egg developing into an insect parent are very, very high. Of course, insects lay a staggering number of eggs. And the world is still populated by a staggering number of insects.

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1 *gorge* - to eat large amounts

2 *exquisite* - finely detailed

- 1 Which sentence from paragraphs 1 and 2 **best** states the main idea of the article?
- (A) “Birds, mammals, lizards, snakes, frogs, toads, and especially spiders all depend on insect meals for their survival.”
- (B) “Insects, naturally, have developed a few ways to avoid joining any of these companions for dinner.”
- (C) “No matter how well-armed or -legged an insect might be, it is always far better to flee than to fight.”
- (D) “The need to escape predators was surely at least one of the pressures behind the development of insect wings.”

- 2 Based on paragraph 7, what function do the bold markings on most poisonous insects serve?
- (A) They provide a disguise.
- (B) They help to locate food.
- (C) They attract possible mates.
- (D) They warn enemies of danger.

3 Based on the article, which method of defense involves blending into the environment?

(A) flight

(B) mimicry

(C) camouflage

(D) echolocation

4 Throughout the article, what does the author **mainly** use to support statements about the defense systems of insects?

(A) Factual examples

(B) personal narratives

(C) opinions from scientists

(D) conclusions and experiments

5 Read the sentence from paragraph 4 below:

Certain water beetles fire pellets of waste from their rear ends as they swim away from pursuing fish.

In the sentence, what part of speech is the word *fire*?

- (A) verb
- (B) noun
- (C) adverb
- (D) pronoun