

A female Eastern Tiger Swallowtail, nectars on tithonia. Females have a bit of blue on their hindwing. (Photo: J. Morton Galetto)

Nature's Mimics

Tigers to butterflies, mimicry serves them all

By J. Morton Galetto

In December of 2015 I went to India to attend a wedding. After many days of festivities we visited Pench National Park to see one of India's most famed animals, the Bengal tiger. Rudyard Kipling's famous work "The Jungle

Book" takes place in Pench, located in the heart of India. The jungle was home to so many animals that we had not seen before, including langur monkeys, Malabar pied hornbills, jackals, scops owls, white throated kingfishers, crested hawk-eagles, green bee-eaters, wild peacocks, myna birds, magpie robins, Alexandrine parakeet, crested serpent eagle, and wagtails.

We heard and saw spotted deer that alert each other to the presence of tigers with a yelped wail. Conveniently their warning calls also alert guides. When the signal is heard chaos erupts, as open-top safari truck drivers jockey for position hoping to show their paying clients a tiger. Our guide explained that Indian tourists are intolerant of failing to see one of these famed creatures. While other guides were busy having minor fender benders our driver decided to go off in a different direction, and in short course a tiger proceeded to follow our vehicle. Tigers, we were told, like to walk the roads in the park because the groomed roads are easier on the pads of their sensitive paws. This one was massive, graceful, just beautiful.

Admittedly in Southern NJ we don't have tigers, but clearly one of our flashiest butterflies is the Eastern 'Tiger' Swallowtail. With its

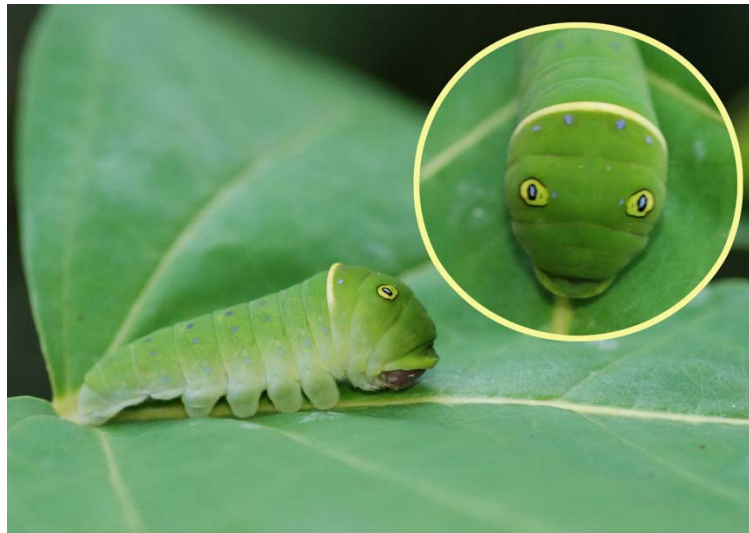
predominantly yellow coloring and contrasting black design it's a show stopper. The upper side of the forewing has black stripes that earn it the common name "tiger." The female's hind wing has blue along the border, more so than the male.

However some females have a unique look: a very dark coloration. A black or nearly black hue in animals that is not typical of their species is called melanistic. In the case of the E. Tiger Swallowtail this morph is caused by a gene on the W chromosome which is unique to the female. Michael Gochfeld and Joanna Burger cite many sources in their book *Butterflies of New Jersey* to help us understand this morph or variation.



The dark morph of the female Tiger Swallowtail occurs in only about 2% of the species. The author caught this picture of a male flying past a melanistic female. There is variability in the degree of blacken coloration. (Photo: J. Morton Galetto)

The situation is thought to be one of mimicry, when an animal resembles another creature or object in nature in order to deceive a potential predator. One common form of camouflage is for young caterpillar species to resemble a bird's droppings, such that a bird ignores a potential meal. Walking sticks look like thin branches. Butterflies sport 'eye spots' on their hind wings to scare off small predators. In the case of larger threats a perceived eye might be attacked while still leaving the wing functional, with a hole in place of a spot. Also when wings are rapidly opened the decorative eye can cause a startle response (as can a brightly colored upper side e.g. Red Admiral), allowing a precious second or two for the prey to escape an attacker.



This is the larvae form (4th instar); note the countershading and false eyes on the inset. (Photo: J. Morton Galetto)

Batesian mimicry, named for 19th century English naturalist Henry W. Bates, refers to a benign and palatable animal looking like a dangerous or noxious species to discourage a possible predator. Many creatures' genetics have evolved to include this trait. The harmless hognose snake flattens its head when disturbed in order to mimic a venomous species. Several species such as New Jersey's seldom seen scarlet snake, with its red, black and yellow rings, have *aposematic coloration* to look like the poisonous coral snake.

In our subject's instance, a melanistic E. Tiger Swallowtail resembles the darkly colored Pipevine swallowtail that is unpalatable. This helps to protect it from becoming a meal. In areas where Pipevine butterflies exist more females have melanism. In fact in the late 1800s it was reported that in the Philadelphia area both morphs, the yellow and the dark-shaded females, were equal in number (Skinner/Aaron – as cited in Burger/Gochfeld).



In NJ these butterflies also mimic the toxic Pipevine Swallowtail in order to discourage a would-be attacker. Top left: Pipevine Swallowtail (Photo: Candace Martino), top right: Red-spotted Purple (Photo: John Flannery), bottom left: Spicebush Swallowtail, bottom right: Black Swallowtail. Many predators see ultraviolet colors so what we perceive is different; furthermore the underside hind wing is more similar in some of these species.

In New Jersey we have a number of other butterflies that mimic the Pipevine, with the Black and Spicebush swallowtails and the Red-spotted Purple also relying on a likeness to this less-favored creature. However the Pipevine butterfly is essentially absent from the NJ Coastal Plain, with only a few reported each year in Southern NJ. Their food plants are various vines in the genus *Aristolochia* or Dutchman's pipe, and this limits their distribution. Dutchman's pipe is not native to Southern NJ, so only where people have planted it would you likely see the Pipevine Swallowtail. Aristolochic acid

(AA) makes both their caterpillar and adult form poisonous.

Dr. Michael Gochfeld, toxicologist and ecologist, shared an article with me from Chemical Research and Toxicology that links AA to the cause of a mysterious kidney disease in Eastern Europe causing Balkan endemic nephropathy. Evidently enough of these plants are growing around wheat fields that its seeds are dispersed into wheat harvests, making their way into people's diet. AA was used as an herbal remedy for arthritis, gout, and inflammation but has been banned by the FDA and its global counterparts because of its toxicity.

In the butterfly world another common Batesian mimic is the Viceroy that closely resembles the unpalatable Monarch, which acquires its toxic steroids from cardenolides by feeding on milkweed. A number of other insects mimic bees, including flies, beetles, and even some moths. In mammals, cheetah cub infants resemble honey badgers that are formidable opponents, thus discouraging predation (R. Eaton). On coral reefs some 60 species of fish are said to be perceived as models of other less-favored species. The human eye may not recognize them as such but the ultraviolet-sensitive eyes of fish at depths can do so.

Conversely our primary subject species, the Tiger Swallowtail, is polyphagous, or, said differently, "it's not a picky eater." Not only is it not picky but those food items that it selects are plentiful so its distribution is wide-spread, covering all states east of the Continental Divide. The host plants for its larvae are tulip poplar, sweetbay magnolia, ash, cherry, birch, cottonwood, willow, plus others. Like most butterflies, to see them frequent your yard you will want to provide native host plants and nectar sources. Joe Pye and the non-native tithonia in my yard seem to be a hit with many species, especially Tigers.

The Tiger caterpillar's first three molts resemble, or yes, mimic, a bird's droppings. The fourth instar (stage in the molting process) is green with lighter shading at the bottom or "counter shading," which helps give it less contrast against a leaf's surface and makes it harder to see.

Caterpillars are divided into segments: a head, three forward segments called "thoracic" T1-3, and the remaining "abdominal" segments A1-10. The upper side of the T-3 has a set of false eye spots, which is a deceptive coloration that fools predators into thinking it is much larger than it is.

There is also a ridge of yellow after A-1 that folds in upon itself at rest. And there are lovely blue spots on the abdominal segments.

The caterpillar is equipped with a defense mechanism found in all swallowtail larvae – a gland called osmeterium that is situated in a segment just behind its head. When threatened the larvae everts the organ, extending it upwards while emitting an odor that most people find disagreeable, and I suppose some predators do too.

With all this discussion of mimicry it is still safe to say that we won't mistake the butterfly for a feline. But I hope I have generated some degree of excitement. My point in starting off with a safari is to suggest that our fauna here in Southern NJ is also special and... yes, we have tigers too!

Sources:

Special thanks to Michael Gochfeld for his insights and documentation.

Butterflies of New Jersey, Michael

Gochfeld and Joanna Burger

Randal Eaton, Possible Case of Mimicry in Larger Animals, Society for the Study of Evolution, V30 Issue 4 pp. 853-856

K.Cheney and N.J. Marshall, Behavioral Ecology V20, Issue 20

Kaufman Field Guide to Butterflies of N.
America (J. Brock and K. Kaufman)
Caterpillars of Eastern North America,
David L. Wagner
Chemical Research in Toxicology,
Etiology of Balkan Endemic
Nephropathy: An Update on Aristolochic
Acids Exposure Mechanisms, C. Chan,
et al. 2018

Eastern Tiger Swallowtail Life Cycle

Egg 4-10 days, depending on
temperature and host plant

Caterpillar/Larval 3-4 weeks

Chrysalis/pupal 10-20 days – except
for overwintering pupae

Adult butterfly 6-14 days