"STAR" Pollinators

CREATURES SELDOM SEEN ARE REAL POLLINATOR STARS UNDER THE MILKY WAY

STORY AND PHOTOGRAPHS BY DAN ZARLENGA

The sun's final rays have flickered below the horizon. Altair, Deneb, and Vega — a triad of jewels — sparkle from the dusky sky. A tiny leg brushes across a stamen, the male reproductive part of a flower. Golden specks with life-generating powder adhere to its delicate hairs. Lured by nectar, an insect wings the grains of pollen through the darkness. An encounter occurs at another flower, this time with the female structure, the stigma. This nighttime transfer will propagate a species.

Many know of the essential pollination services our native bees provide. And who hasn't admired those most glamorous of pollinators, the butterflies? But when it comes to this all-important process, who are the "stars" of nighttime pollination?

Limited research has been done on pollination after dark, yet most naturalists and biologists agree that it occurs.

A 2011 experiment by researchers from Nova Scotia's Dalhousie University measured pollination conducted in enclosures of berry-producing plants. Using netting, researchers made some plants accessible to insects all day and night, some only during the day, and another set only at night. The results showed that nocturnally accessible plants produced about one-third as many ripe berries as the plants accessible by insects for the entire 24 hours. This suggested 33 percent of all pollination occurred after sundown.

A multiyear study published in 2021 by the Entomological Society of America demonstrated a practical relationship between nighttime pollinators and food crops. Researchers at the University of Arkansas examined the role night pollination played in the output of apple trees. Using selective exclusion methods like Dalhousie University, their work showed nocturnal pollinators enabled trees to produce as many apples and at the same levels of pollination as their daytime counterparts. The study concluded that night pollination contributed significantly to apple production.

A lot of plant pollination happens at night. Even nocturnal insects, like this bush katydid shown on rattlesnake master, might help spread pollen.

Enter the Mighty Moths

When we explore the night pollinators in Missouri, it is the moths — cousins of butterflies — who emerge as the stars under the stars. There are about 160,000 varieties of moths in the world, and most of these are nocturnal. North America has 12,000 moth species, and they are an extremely diverse group of insects in size, shape, coloring and habits. Turns out these little moths do the lion's share of the work.

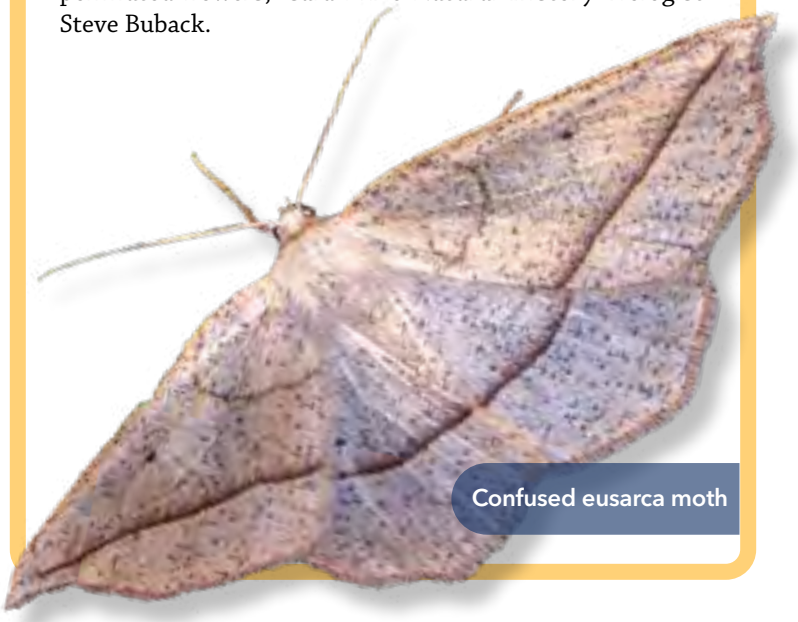
"They outnumber the butterflies many times," according to Chris Hartley, entomologist with the Sophia M. Sachs Butterfly House in Chesterfield. "They're more significant pollinators without a doubt than butterflies because there are more of them."

A combined study carried out in 2018 by the Universities of York and Hull in the United Kingdom and Australia's University of Newcastle discovered that moths do indeed spread pollen over large distances during the night.

The research traced pollen carried by moths using cutting-edge pollen DNA detection methods. "Over half of the plant species we detected were not previously known to be visited by moths," wrote the study's lead author, University of York's Callum Macgregor. The research revealed that moths bore pollen from many of the same plant species as bees and butterflies. "Moths appear to complement the work of bees and can carry pollen over greater distances as they don't have the same ties to a particular part of the landscape," Macgregor concluded.

Of course, the plants have long-since figured this out for themselves, and some bloom after dark specifically to attract moths. One of the most conspicuous night flowers in this state is the Missouri evening primrose. It produces showy, yellow blossoms up to 5 inches in diameter and are often found on dolomite glades or dry, rocky prairies. This plant relies on moths for its propagation. Its light-colored petals are easier to see at night, and the flowers give off a strong scent in the evening that attracts moths.

"Primrose species we kind of think of being classic night-pollinated flowers," said MDC Natural History Biologist Steve Buback.



Confused eusarca moth

"In most plants, pollination is a kind of partnership between plant and pollinator."

–CHRIS HARTLEY, ENTOMOLOGIST

A crane fly drinks nectar from a glade coneflower. Both flies and midges are important night pollinators.

Buback has spent time on Missouri's southwestern prairies studying another wildflower which takes advantage of night pollinators — the prairie fringed orchid. Like the evening primroses, its flowers are light in color. This endangered grassland plant blooms day and at night, but its fragrance becomes stronger after dark to draw in nocturnal hawk moths.

Hawk moths, also known as "hummingbird moths," come from the sphinx family of moths. Many species of this family inhabit Missouri and are excellent examples of night pollinating moths. They are characterized by thick, robust bodies and zippy flight patterns that mimic the hummingbird. Hawk moths have exceptionally long proboscises, structures they use to draw out nectar from flowers. Their stout, hairy forms are like boxcars that transport large loads of pollen.

"In most plants, pollination is a kind of partnership between plant and pollinator," Hartley said. Numerous plants have structures evolved to get more pollen dusted onto their primary pollinating visitors. The more an insect interacts with a plant, the more pollen rubs off on it. "The plant has 'rigged' its nectar reward so that the insect has to run through the pollen to get to it," said Hartley.

The relationship is mutually beneficial, Hartley stressed. "The pollinator is coming away with a belly full of nectar, so it's getting a great reward."

Stealing the Night Away

Nocturnal pollinators that depend on darkness to do their work are being robbed of the night. Growing evidence shows excessive artificial light has intrusive and negative effects on our natural ecosystems. Night creatures are being confused, distracted and disoriented as nights grow ever brighter under artificial illumination. More than just a loss for astronomers and poets, the erasing of the night sky impacts natural processes from bird migrations to night pollination.

Who hasn't seen a moth mesmerized around a street lamp? It is believed many night creatures use the moon and stars to help navigate. These distant light sources are relatively fixed visual references, providing constant bearings to follow. By contrast, the closeness of a porchlight mere inches or feet away makes the light's position appear to constantly change from the moth's point of view as it flies. The insect is forced to alter course continually trying to keep the light in the same orientation, which launches it into a confused, never-ending orbit.

"What do you think those moths would be doing if they weren't attracted to that light? They'd probably be out pollinating," said Hartley. "They're spending their whole night at these lights instead of out there visiting flowers."

Clockwise from left to right: celery leafeater moth, midge, Missouri evening primrose, eusarca moth on a coneflower, master's dart moth on thistle, soldier fly, eupithecia moth on white sweet clover, helicoverpa moth on white snakeroot.

Supporting Players

Moths aren't they only players in the night pollinating game. Hartley said there's a lot of compelling evidence that flies are also significant pollinators. "After bees, the consensus is that flies are the world's second most important pollinators, night and day both," he said. Both flies and midges visit flowers at night seeking nectar as well and spread pollen in the process. In fact, some plants can only be pollinated by flies. With over 150,000 species documented worldwide, flies most certainly interact with a tremendous number of plants in the dark of night.

Members of the largest order of insects in the world, the beetles, also participate in nocturnal pollination. For some plants, their services are essential, but for many others pollination by beetles is more incidental. Yet, considering beetles make up around 40 percent of all insects known worldwide, even when their pollination impact is accidental, it adds up. Scarab and soldier beetles spend a lot of time in flowers and are among the more effective pollinators, Hartley pointed out.

Some of the most mesmerizing pollinators may be fireflies. Also known as lightning bugs, these insects are neither bugs nor flies. They, too, are beetles. Their magical flashes may all look similar to us, but there are many different species of fireflies found in Missouri.

Humans may not appreciate mosquitos, but nocturnal plants don't hesitate to court their pollinating favors. The female mosquitos are the ones that suck blood, using the proteins to produce their eggs. Aside from that, adult mosquitos are quite content to feast on the ambrosia of flowers during the night as they carry pollen from plant to plant. It sure seems there are plenty of them out there to do the job.

"If insects are visiting and they're drinking nectar, then there's a chance they're going to transfer pollen from one plant to another," Buback said of the night pollinating crowd.

An encounter with other random night bugs could occasionally move pollen among plants as well. This is less likely with insects that don't eat pollen or are not consistent in the plants they visit, such as katydids, but it is still conceivable. There's evidence to suggest katydids might play a bigger pollinating role in some other ecosystems. Bats perform vital pollination duties in parts of the world too; however, none of the winged mammals found in the Show-Me-State do so.

Shift Workers

Not all nocturnal pollinating happens at the same time. During the night shift, different species split their duties

Here are some things we can all do to help minimize the effects of light pollution:

- Use lighting only when needed. Don't leave porch and yard lights on all night; light just the areas with a real need for light; avoid decorative or landscape lighting.
- Employ fully shielded fixtures that direct all the light downward where it is truly useful. Scattered light in other directions wastes energy and creates glare, making it harder to see.
- Choose lights that are no brighter than required, the lower level, the better.
- Turn lights off when not needed or use timers so they are not on all night. Employ motion-detection lights over constant ones where security is a concern.
- Use lights with warmer colors, like yellow and orange. Reduce the use of shorter wavelength lighting such as blue and violet.
- Urge friends and neighbors to do the same, and everyone will save energy costs too!

With a little enlightenment on outdoor lighting, we can make it easier for our "star" pollinators to do their indispensable work. For more information, visit DarkSky Missouri at DarkSkyMissouri.org

The dazzling fireflies, which are actually beetles, also help pollinate.

into distinct "sub shifts." The nocturne begins an hour or so before sunset with the crescendo of the crepuscular crowd, or twilight insects, as they come out to play. While the night progresses a variety of species bow in and bow out of the pollination performance; still others dance all night long. It's a complex symphony orchestrated by changing light levels and other influences yet unknown, all set to the mysterious music orchestrated by evolution.

Where night pollinating is concerned, there are some insects who are all show and no go. The silk moths are among them, like the eye-catching polyphemus and luna moths. They have reduced mouth parts and no digestive tracts. These insects are much too busy showing off for mates during their short adult lives to bother with eating. They have little inclination to eat or pollinate and use plants merely as spots to rest from their amorous activities.

Still, that leaves plenty of pollinating to go on after the sun goes down.

Waste No Time

"We as human beings don't often think about what happens after we go to bed because we are diurnal animals," Hartley said. "Our biology is to be awake during the day, so we kind of forget about how important everything else is."

While bees remain the world's prime pollinators, Buback also feels the "star" pollinators should not be overlooked. "Some plants have adapted to night pollinators, so they've got to be doing some good work out there."

Think about it. Life on Earth spends half its existence under night. If nature didn't put all those hours to good use, wouldn't it be an awful waste of time?

Thanks to an army of nocturnal pollinators, a lot can and does happen under the stars. ▲

Dan Zarlenga is the MDC media specialist for the St. Louis Region. He likes to discover nature mostly through hiking, backpacking, day and nighttime photography, and an occasional float trip.

This common Eupithecia moth larva will mature into an adult moth and join the army of nocturnal pollinators.

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ON THE COVER

Three *Eusarca confusaria* moths pollinate a pale purple coneflower.

DAN ZARLENGA

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