

## Comic book heroes aside, spiders are the real webmasters

by Scott\_LaFee

Forget Spider-Man, who for all his cinematic web-slinging is still pretty much a one-trick phony. If you want to see truly marvelous silk savvy, look for the real thing: spiders.

GOT SILK? - A wasp spider sits in its web. Some spiders produce as many as seven kinds of silk, including dragline silk to support the spider as it moves about and adhesive silk for snaring prey. CNS Photo. Of course, they have had plenty of time to perfect their craft. Based on fossilized evidence, spiders have been sporting spinnerets - the structures on their abdomens that extrude silk - for at least 400 million years.

Last June, researchers at the American Museum of Natural History described their discovery of the world's oldest spider web: five connected strands, complete with trapped prey, preserved in 110 million-year-old amber.

### HITTING THE SILK

There are at least seven kinds of spider silk.

"All spiders spin at least one kind, and some spiders can produce seven different types," said Cheryl Hayashi, a biologist at University of California Riverside.

The strongest is dragline silk, which must support the weight of the spider as it moves and swings about. There's also walking silk, adhesive silk for snaring prey, silk used to bind other kinds of threads together, cocoon-building silk, and silk for wrapping up and immobilizing captured prey.

Most of these kinds of silk are used to make webs, something the majority of the 39,000 known spider species do (in varying ways).

But silk has other uses among the eight-legged set.

In September, for example, researchers at Riverside and elsewhere discovered that Costa Rican zebra tarantulas secrete silk from spigots on their legs, allowing them better to cling to slippery surfaces.

Trapdoor spiders build corklike plugs of soil, vegetation and silk to cover their burrows, then lurk just inside, peeking out, waiting for passing prey.

Lynx spiders, too, rely on stealth and speed to catch prey, but they also take precautions, spinning out a silken lifeline. If they miss their target and take a tumble, the line helps them return to their original position.

Tiny parachute spiders cast long, single strands of silk into the air - like a kite string without the kite - then wait for a breeze to carry them away toward new territory. The distance traveled is usually just a few feet, but spiders have been found on lifeless islands hundreds of miles from the nearest land and drifting through the atmosphere 14,000 feet above sea level.

The water spider is the only truly aquatic spider. It lives and feeds underwater, but breathes air. To do so, it weaves a domed, airtight web and anchors it underwater. Then the spider drags air bubbles captured in its body hairs inside the sunken web, which now serves as a sort of oxygen tank.

Bolas spiders dangle a lone silk thread from their web, the end daubed with a sticky blob. For bait, they exude a pheromone similar to one emitted by female armyworm moths. Attracted male moths blunder into the blob, get stuck and become dinner.

## STRONG STUFF

Much is made of the strength and durability of spider silk. Certainly, it's among the more remarkable substances in nature: five times stronger than steel by weight, twice as elastic as nylon, harder to break than rubber.

These attributes have long made spider silk useful to humans. South Pacific cultures have used it for fishing lines, carrying nets and hats. It has been woven into fabric and used for surgical sutures and for the cross hairs in gun sights.

The problem, of course, is that it takes a lot of spiders to make a lot of silk. (A French inventor once collected 1.3 million spider cocoons to create 2 pounds of silk fabric.)

Materials scientists have been trying for decades to create artificial spider silk that could, like the real stuff, be produced at room temperature, low pressure and with renewable resources. They're still trying.

Genuine spider silk is a complex formula of proteins. Its DNA is repetitive and hard to decipher; only a handful of sequences have been decoded. And spiders, which tend to be solitary predators, aren't the easiest lab animals to work with.

In time, perhaps, scientists will learn how to make spider silk. They may even leave the spider out of the equation altogether. A Canadian biotechnology firm has successfully produced spider silk protein in the milk of genetically engineered goats, but the company has yet to bring a product to market.

So, in the meantime, there's Peter Parker (aka Spider-Man) at a theater near you. Or even nearer, there's a spider. It's estimated that at any given time, at least one spider is lurking within 3 feet of you.

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