



Clockwise from far left: Figure 1. Female crab spider with large prey. Figure 2. Crab spider lying in wait under a petal. Figure 3. Crab spider ambushes prey from between petals. Figure 4. White Misumena on a blue flower; do insects spot her as easily as we do? Figure 5. Female crab spiders are much larger than their mates.

SPECIES SPOTLIGHT:

Crab Spider: *Grasslands Predator Hiding in Plain Sight*

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All I wanted to do was immortalize this tiny hunter and its incredible prize in a photograph. How could this furtive little acrobat hide from me in plain sight, isolated as it was on a buttercup (*Ranunculus californicus*), in the middle of a grassland? Yet each time I focused in on the crab spider (*Misumena vatia*) with its prey, it scuttled around the yellow bloom just enough to escape my shutter. And the spider managed this deft avoidance with only half its complement of eight legs, because the other half were holding on to the much-larger wheat stem sawfly (*Cephus cinctus*) it had just captured (Figure 1). After several minutes of frustration, I realized that the spider was winning the intelligence contest and I'd need a strategy to get that photo. I removed my backpack and left it on the ground, hoping the crab spider would perceive it as threat. It worked; the spider retreated again as I circled around the flower but then stopped cold when it saw the backpack. Confronted with a threat on each side, it froze in place. I got the photo, but I'd had to resort to trickery. This was my first encounter with a crab spider and I was impressed. I had to know more about this little wonder.

In grassland ecosystems, which cover more than 40% of Earth's land surface, grasses comprise the greatest number of species, but many other plant types grow there as well. To fully appreciate the species diversity within a grassland, you need only stroll through it and observe closely, noting the seasonal changes and distributions of plants. Crab spiders are common predators in grasslands, and they conduct their action-packed lives in plain sight, atop a succession of wildflower species that bloom as the seasons change from spring to fall. A wide distribution, conspicuous habitat, and easily observable traits make this species attractive to researchers (Morse 2007).

Crab spiders are sit-and-wait predators, ambushing insect prey that visit flowers. They belong to the group of spiders (Thomisidae) that derives its common name from its members' tendency to scuttle sideways like a crab. They possess two large, raptorial forelegs with which to grab prey, and powerful venom with which to subdue it. These two adaptations allow them to capture prey much bigger than

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themselves. In the way of all spiders, they employ external digestion, which means they do not have to physically break down their prey to consume it—so prey size is not such a limiting factor for feeding, either. They inject their prey with digestive enzymes that reduce the useable parts to liquid, which the spiders then siphon from prey as if drinking through a straw, leaving the prey looking much as it did prior to capture. (Look closely in a grassland and you'll see these exoskeletons hanging, ghostly, where they died.) Female crab spiders are larger than males; this allows them to capture and consume larger prey than their male counterparts, thereby attaining even greater size. More about why this matters in a moment.

Crab spiders "conceal" themselves from prey in two ways. First, they may take a position under the petal of a flower, between blooms, or under leaves (Figures 2, 3). The second means of concealment may have to do with the ability of both sexes to change their color (females, more conspicuously) over a few days' time. Yellow and white are the most common colors for *Misumena*, and to the human eye these colors appear to approximate the color of the blooms on which the spiders hunt (Morse 2007). Most insect prey, however, see light differently than we do; whereas we might easily spot a white *Misumena* on a blue flower (Figure 4), insects perceiving ultraviolet wavelengths might mistake the spider for a strongly patterned flower part (Heiling et al. 2003), if they see it at all. The ability of crab spiders to play off the background color of their hunting grounds conceals them in plain sight...and gets them closer to their prey.

Some research suggests that sexual selection may have caused spiders to evolve to change color. Théry (2007) determined that color changes in crab spiders were triggered by the visual spectrum of the reflected light of their background, and that pigments from digested prey were used by the crab spider to change its color. Théry hypothesized that a highly pigmented female may be more attractive to males because her coloration is indicative of her hunting ability and overall fitness. Size matters in mate selection too; larger females produce larger litters (Morse 2007). Males that choose larger females increase their chances of passing their genetic material on to more offspring (Figure 5), and those offspring have better odds of surviving to adulthood, breeding, and perpetuating the male's genes (Fritz and Morse 1985; Morse 1989; Morse 2007).

For most of her life, a female crab spider aggressively defends her territory, keeping males and other females from the flower on which she hunts. Only at the end of her second year does she allow male spiders into her territory. She might mate with more than one male, but the male that mates first has a much greater chance of fertilizing the majority of eggs the female produces. When the female is ready to lay eggs, generally in late summer, she descends the plant stalk to locate a choice leaf; she then bends the leaf tip back and secures the folded-over end with silk, forming an envelope-like cocoon. She deposits her eggs inside the envelope and guards them closely until they hatch, in about 3 weeks. Adult females do not survive their second winter. After guarding her eggs until they have hatched and her spiderlings have dispersed, the female crab spider's two-year life cycle ends. The young pass the remaining fall by hunting for appropriate-sized prey such as thrips (Thysanoptera), aphids (Aphididae), and dance flies (Empididae) among the leaf litter (Morse 2007). The larger they can get before the first frosts arrive, the better their chances of surviving the winter until a wider choice of prey becomes available as Spring arrives. A diet of nectar and/or pollen may get them through lean times until prey is more abundant (Vogelei and Greissl 1989).

Adult *Misumena* don't travel much more than a few meters within their feeding areas. A crab spider's success comes down to its ability to choose a piece of real estate on which flower species bloom in succession throughout the spring, summer, and fall growing seasons. The ability of a female crab spider to choose a foraging patch likely to provide abundant prey may determine the success of next generations, as well (Morse 1993). Ideally, the patch the female chooses for herself is of a quality to sustain some or all of her offspring in their own quest for food. If the spiderlings find their mother's patch lacking in resources, they can move, but moving comes with its own risks. Crab spiderlings, like the offspring of other spider species, *can* disperse great distances by ballooning, but that leaves the quality of landing-place resources entirely to chance.

This dynamic effort to thrive is taking place right under our noses every year. In my patch of Sonoma County, I see the first crab spiders of the year in the March flush of buttercups. As successive flower species erupt through the spring, I see the spiders on wild hyacinth (*Dichelostemma capitatum*), yarrow (*Achillea millefolium*), and mule ears (*Wyethia mollis*); then, in summer, on yellow mariposa lilies (*Calochortus luteus*); and finally, on the harvest brodiaea (*Brodiaea elegans*) of fall.

All you need to do in a grassland is look closely.

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