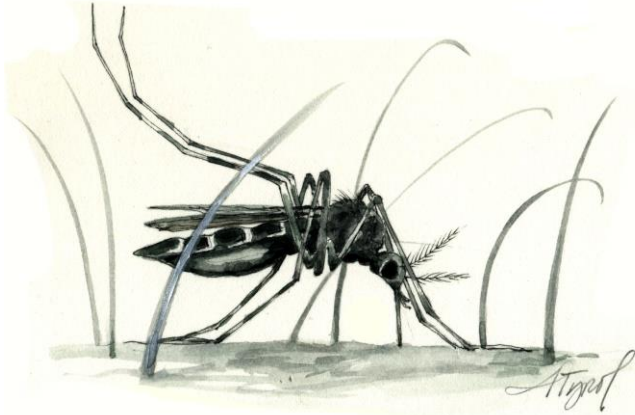


The Outside Story



Mosquitoes: Life Under Tension

By: Declan McCabe

A good friend was in touch; her son was enduring allergic reactions to mosquitos and, like any good parent, she sought solutions. I told her that the most practical, non-toxic way to deal with the problem was to consider a mosquitos' lifecycle, and interrupt it where it starts.

Mosquitoes begin their lives in eggs laid singly or in rafts, in most cases on the surface of water. We purchase mosquito egg rafts at Saint Michael's College to run student experiments with the hatching larvae.

A female mosquito, potentially using your blood or mine for energy, delicately alights on the water to lay her eggs. Humans, operating at entirely different scales, fail to alight on water; we break through the surface and, if all goes well, we float. Alighting is not the same as floating – in fact some insects such as water striders are denser than water and therefore cannot float. Rather, insects are held up by surface tension.

Water molecules pull together, as you can witness when water beads up on a waxed surface. In a pond, or droplet on your tent fly, water molecules are more strongly attracted to each other than to gas molecules in air. Forces of attraction in water are strong and provide a skin-like structure on water that can support a small insect.

Surface tension is strong enough to hold up steel. To see, lay a sewing needle flat on tissue paper; lower the tissue into water and let it saturate and sink. If all goes as planned, the needle will remain on the surface. And steel needles do not float; prove it by touching it with your finger. When your salty skin breaks the surface tension, the needle will sink like any well-behaved piece of steel.

Mosquitoes are neither dense as steel nor absorbent like tissue paper. Their 'feet', or tarsal leg segments, repel water. Professor Wu and colleagues from Dalian University of Technology in China found that mosquito leg scales have nanoscale ridges and cross ribs that allow them to safely land and take off from the water surface. So hydrophobic are these scales that Professor Wu calculated they could bear more than 23 times the weight of a mosquito on the water surface, making a water strider's legs, which can support only 15 times that insect's weight, look positively wimpy.

When mosquito eggs hatch, the larvae, or "wrigglers," are vaguely tadpole shaped but smaller. They breathe air through a rear-mounted snorkel or siphon. The top of the siphon has five flaps that, when submerged, close to form a protective cone that keeps water out. When the siphon breaks the water surface, the flaps open to form a floating triangle shape from which the resting larva hangs. Like other arthropods, growing larvae shed their exoskeletons several times as they grow from hatchling to full-size larva. And then they transform to a pupae that's unique among insects.

When I think "pupa," I remember my children's copy of Eric Carle's *Very Hungry Caterpillar*. The

pupa, or cocoon, sits quietly until a spectacular adult emerges. Mosquito pupae hang from the surface tension, but at the first hint of danger, like the shadow of a passing bird or biologist's net, they actively swim to depth. And when the danger passes, they bob right back up and take another breath. From the water surface, the adult mosquito, balancing precariously on the skin of its earlier self, emerges vertically, pulling legs and wings out from its still-submerged pupal husk. I would have thought it akin to taking your pants off, one leg at a time. But YouTube videos suggest otherwise: the legs pop out in pairs or all at once and the fly can immediately walk on water or take off directly.

Most facets of mosquito life depend on surface tension. An aerator added to a bird bath, or a pumped waterfall or fountain in a garden pond, is enough surface disruption to stymie mosquito plans.

Mosquitoes did just fine before bird baths and garden ponds; they reproduce in any standing water, and some species in very polluted and/or stagnant water. Air breathing helps them survive inferior water quality. We provide many suitable habitats: discarded buckets, tires, beer cans, even a water-filled hoof print will do. That tarp ignored on your woodpile all summer may well be the source of winged vampires. And a clogged gutter, from a mosquito's point of view, is a linear pond in close proximity to fresh food on the hoof or sneaker.

So eliminating places for water to accumulate can reduce mosquito populations around your home. Perhaps you'll eliminate some other tensions from your life in the process!

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