Scientists uncover re-evolution of disruptive camouflage in horned praying mantises

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Researchers identified and named a new genus of horned praying mantis, naming it *Alangularis* for its angled wings. Credit: Rick Wherley

A scientist from The Cleveland Museum of Natural History led research that revised the horned praying mantis group and traced the evolution of its distinctive camouflage features. Dr. Gavin Svenson and his colleagues identified a new genus and new tribe of praying mantis and discovered that disruptive camouflage evolved twice within the group. The second, more recent, occasion occurred after the re-evolution of a special leg lobe that disguises the body profile to help the insect hide from predators. The research was published Nov. 16, 2015 online in the journal *Systematic Entomology*.

Svenson and the team studied the origins of 16 features that provide disruptive crypsis for the Central and South American horned praying mantises of the subfamily *Vatinae*, all of which contribute to their camouflage strategy. These features include a head process or horn and leafy looking lobes on the legs. The team analyzed 33 species and nearly 400 specimens from Museum collections in the United States, South America and Europe as well as insects Svenson recently sampled from South America.

"Praying mantises depend on camouflage to avoid predators, but we have known little about the patterns of how body structures contributing to crypsis evolved," said Dr. Gavin Svenson, curator of invertebrate zoology at The Cleveland Museum of Natural History and lead author of the study. "We discovered that two mantis lineages evolved structural camouflage millions of years apart in very similar ways. This not only suggests that re-evolution occurred, but demonstrates that the developmental mechanisms controlling cryptic features may be more ancient than the camouflaged mantises themselves."

The research revealed that leafy lobes on the middle and hind legs evolved during the first origin of the horned mantises. Afterward, one lineage invested in a camouflage strategy and began to accumulate other leg lobes, an extended head process or horn, and even lobes on the abdomen, while the other lost these early evolved leg lobes and relied only on coloration to blend in with vegetation. However, a second, smaller lineage of mantises within this color camouflaged group began to gain disruptive cryptic features about 20 million years later after the re-evolution of those same early originating leg lobes. This second shift to a strategy of disruptive camouflage appears to have followed a remarkably similar path as the first through the accumulation of leg lobes in the same positions, as well as a similar extended head process or horn.

Researchers suggested that the second origin of disruptive camouflage was most likely controlled by genetic and developmental mechanisms that were already present. Essentially, the capability to evolve camouflage was already in the genetic toolkit of the lineage and those features re-emerged when it was advantageous for survival. According to Svenson, since many other, more distantly related, mantis groups have disruptive camouflage, it may have evolved very early in praying mantises and is mostly a matter of being turned on or off in a variety of ways.

The scientists used DNA sequence data generated in the Cleveland Museum of Natural History's DNA Laboratory and studied morphological features to reclassify the group. The newly identified genus, *Alangularis*, recognizes a unique and colorful species of praying mantis that was incorrectly included within another genus. The new genus name translates to "angled wings," which reflects its acute wing tips. The new tribe, *Heterovatini*, was established to include two genera that share many characteristics with the rest of *Vatinae*, but retain no disruptive cryptic features other than the shared leg lobes.

This male Vates is a member of the horned praying mantis group that evolved camouflage features including a head horn and leg lobes that disguise it from predators. Credit: Gavin Svenson

"Finding that camouflage evolved twice in the horned mantises was surprising," said Svenson. "But even more amazing is how alike the two distantly related camouflaged groups really are and what that means for camouflage evolution in mantises as a whole."

Svenson's research is focused on the evolutionary patterns of relationship, distribution and complex features of praying mantises. His

current research project aims to align new sources of relationship evidence (DNA sequence data) with morphology and other features to create a new and accurate classification system for praying mantises that reflects true evolutionary relationships.

More information: GAVIN J. SVENSON et al. Re-evolution of a morphological precursor of crypsis investment in the newly revised horned praying mantises (Insecta, Mantodea, Vatinae), *Systematic Entomology* (2015). DOI: 10.1111/syen.12151

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