Giant spiders cast webs over river using super biomaterial

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Caerostris darwini, a giant orb spider and namesake of Charles Darwin, weaves a web of tremendous strength and size never before seen. Photo courtesy of Matjaz Gregoric.

(PhysOrg.com) -- The antithesis of the itsy-bitsy spider, *Caerostris darwini*, a giant orb spider and namesake of Charles Darwin, weaves a web of super strength never before seen, says Dr. Todd Blackledge, Leuchtag Endowed Chair at The University of Akron.

Blackledge, an associate professor of biology; Ingi Agnarsson, Blackledge's former postdoctoral researcher at UA and current assistant professor and director of Museum of Zoology at the University of Puerto Rico; and Matjaž Kuntner, chair of the Institute of Biology at the Scientific Research Centre, Slovenian Academy of Sciences and Arts, reveal this new spider species from Madagascar and its incredibly expansive web.

“Darwin’s bark spider or C. darwini,” as it is referenced, makes one of the largest known webs and suspends the giant webs across rivers and lakes, according to the researchers. The scientists say these spiders achieve this feat by using the toughest, most energy-absorbent silk ever discovered, stronger than any other known biological material and most manmade varieties. They publish their findings in the Sept. 15 and 16, 2010 issues, respectively, of the Journal of Arachnology and the PLoS One interactive open-access journal for the communication of all peer-reviewed scientific and medical research published by the Public Library of Science.

This close-up view of a giant orb spider web spanning a river demonstrates the tremendous strength and elasticity of this type of silk. Photo courtesy of Matjaz Kuntner.

In their PLoS ONE paper, Agnarsson, Kuntner and Blackledge report on the testing of material properties of Darwin’s bark spider. The authors predicted that the expansive webs would be spun using extraordinary silk and they proved their prediction correct. First, the researchers

considered that spider silks already combine high strength with elasticity, demonstrate exceptional toughness and are able to absorb three times more energy than Kevlar (a high-strength synthetic fiber) before breaking. The scientists prove that Darwin's bark spider silk is about 100 percent tougher than any other known silk. Subsequently, this spider species produces the toughest biological material known.

Possibilities considered for technological applications

"The incredible toughness of this spider's silk is an important discovery for two reasons. First, it suggests that these spiders may have evolved a novel mechanism for the production or assembly of their 'super silk.' Second, it opens up new technological applications for spider silk that capitalize on C. darwini silk's truly impressive combination of light weight and high performance," Blackledge says.

In the Journal of Arachnology paper, Kuntner and Agnarsson use morphology and DNA evidence to show that the spider is a new species previously unknown to science and also to describe its unique web and habitat. The spider, named in honor of Charles Darwin 200 years after his birth and 150 years after publication of his Origin of Species, builds one of the largest orb webs ever described and suspends those webs across bodies of water up to 25 meters wide.

These scientists believe extreme web architecture and silk properties likely coevolved. "The ancestors of C. darwini were able to occupy a novel niche through a combination of new web building behavior and new silk qualities," says Agnarsson.

"The species may become a model for evolutionary studies, and thus its name after Charles Darwin is very appropriate," adds Kuntner.

Precisely why Darwin's bark spider evolved such unique webs and silk

and how they use their giant riverine webs is currently being investigated by the team through a grant by the National Geographic Society.

Provided by University of Akron