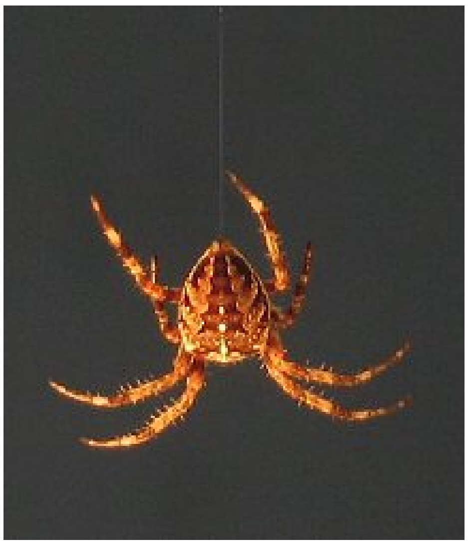
Why spiders' silk threads don't twist

March 30 2006



Araneus diadematus spider dangling from its thread.

Unlike a mountain climber swinging from a rope, a spider suspended from its silk thread hardly ever twists. Although the flexibility and strength of a spider's dragline outperforms the best synthetic fibres, surprisingly little has been published on the twist properties of the thread. A new study however, by a research team from Oxford and Rennes Universities, published in *Nature*, reveals just how good the damping properties of spider silk are.

The researchers used a small plastic or copper rod to represent the weight of the spider, and tied it to a variety of threads. The 'spider' rod was twisted through 90 degrees, to make the rod turn back and forth many times around its original position, and a camera linked to a computer registered the responses of the different threads.

The research team first used a thread of Kevlar, a synthetic organic polymer used in the manufacture of racing cars, known for its strength when stretched. After the thread was twisted around from its equilibrium, it oscillated gently around its original position. The response was elastic with little energy wasted. They then examined a soft metallic copper thread, which twisted a few times in the same experiment, but after several trials became brittle. It displayed the high damping typical of high-energy dissipation. The researchers then used a dragline silk from an *Araneus diadematus* spider, where the oscillation was damped down after a few twists, and unlike the copper thread, the spider silk retained its twisting qualities through several cycles.

Professor Fritz Vollrath said: 'It seems that selection against twisting and swinging in the spider dragline thread has led to the evolution of a shape-memory material that does not need any external stimulus to give total recovery, even if it does take time. The twist properties add yet another beneficial quality to the famously strong silk, and this might have evolved so that an abseiling spider does not swing in a way that might attract predators.'

The researchers intend to carry out further research into this and other silk proteins to see whether sacrificial hydrogen bonds and their reconstruction may form the basis for the observed mechanical behaviour.

Source: University of Oxford

Citation: Why spiders' silk threads don't twist (2006, March 30) retrieved 19 September 2024

from https://phys.org/news/2006-03-spiders-silk-threads-dont.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.