

## Spiders stretch their webs beyond the limits

**S**PIDERS' webs are remarkably elastic, according to scientists at the University of Oxford. Fritz Vollrath, a zoologist, and Donald Edmonds, a physicist, have studied the web of the garden cross spider, *Araneus diadematus*. They compared the physical properties of the stiff "radial" strands of the web with the elastic strands of the "capture spiral". They have found a dramatic difference (*Nature*, vol 340, p 305).

The radial strands of the spider's web are about 1 micrometre in diameter. They are dry, non-sticky and stretch by only about 20 per cent of their original length. The capture strands, on the other hand, are only 0.7 micrometres in diameter and can stretch to four times their original length, then recover with no obvious sag.

The key to this dramatic elasticity, say the researchers, lies in the behaviour of the liquid which coats the fibres of silk protein. This coating, which acts like a glue, consists of 80 per cent water plus a mixture of lipid, amino acids and salts

in solution. When the spider initially spins out the thread of its capture spiral, the forces of surface tension in the glue cause it to form spontaneously into small droplets, each enclosing a tangled ball of silk fibres.

This produces a taut web without any sag.

However when an ensnared insect stretches the capture spiral, the "spare" fibre within the droplets unwinds. Initially, this increases the capture spiral's length enormously. Only when it is at maximum extension do the fibres of silk protein themselves become stretched.

Because the strands of the capture spiral extend rapidly and recover, the web is able to maintain its shape, even in strong winds. This property also provides the web with the "give" it needs to resist the escape of any prey.

As far as researchers know, the "wet" silk that is necessary to provide this ability comes only from orbweb spiders, such as *A. diadematus*.

David Duthie



Steve Buckingharn/Nature

*Super stretcher: a web fibre is coiled up within droplets of "glue". When it comes to unwind, therefore, the fibre's length seems to increase dramatically*