Wonder Science

What natural substance can possibly be stronger than steel? Finer than human hair, lighter than cotton, the flimsiest looking common object, the spider web, is stronger than steel. A pencil thick strand of spider silk could stop a Boeing 747 in flight! In 1881, Goodfellow a doctor in Arizona observed that a spider silk handkerchief stopped bullets. Surely it's the right stuff for a super hero!

The elastic fibres of the golden orb-weaving spider, *Nephila clavipes* and orb-web spider, *Araneus diadematus*, stretch forty times its original length before they break. *Stegodyphus sarasinorum* is another champion weaver. Its fibres stretch up to twenty times! Compare this to man made objects: Steel stretches only eight times, and nylon about 20%.

The spider silk has fascinated scientists, military, and entrepreneurs. Fishermen in Polynesian islands used the thread of *Nephila* as fishing line. New Guinea tribesmen wear waterproof hats made of spider webs! In 1709 Frenchman, Bon de Saint-Hilaire, made fabric from spider silk. About 1.3 million spider cocoons produced one kilogram of spider silk. It wasn't profitable.

The dragline silk enables a dangling spider to plummet down and nab its prey. The survival of the spider depends upon the strength of the dragline silk. The spider silk has evolved and perfected over 400 million years. The race among scientists is now to spin the first artificial silk.

There are several steps to achieve this. First, they must determine the kinds of molecules and their arrangement. Then, the scientists have to identify which genes yield silk proteins, and finally, they have to learn how to spin the raw material.

* Spider's web with dew drops

We now know that the silk has a protein called fibroine. This protein is made of only seven amino acids. How, wondered the scientists, does the silk protein not become decomposed by fungi and bacteria like all other proteins? The spider silk has three important substances that make it durable: pyrolidin, potassium hydrogen phosphate, and potassium

Rani Iyer

SPIDER SILK

nitrate. The pyrolidin binds water and prevents spider web from drying out. It also holds the glue that traps the insects. Potassium hydrogen phosphate makes the spider silk thread acidic and prevents fungal and bacterial growth. Acidity causes curdling of proteins, remember the sour milk. Potassium nitrate salts prevent this.

* Spiderman

Scientists have also identified some large genes, about 22,000 base pairs, that help in producing the spider silk. How many base pairs are needed to make good quality thread? Nobody knows. One scientist in University of Wyoming has cloned silk genes into bacteria. The bacteria can now produce silk protein in solution. He passes the solution through a fine tube to make synthetic silk fibres. The resulting fibre will not resemble spider silk, but still be a good fibre.

There is one thing scientists can't do yet. Recycle the silk. Spider recycles the silk by eating it! Bad weather or catching prey can destroy the web. The spider simply eats up the old web and constructs a new one in its place!

* Spider's web in a park