Shrimp-like crustacean found to make gooey underwater silk

November 23 2011, by Bob Yirka

[i]Crassicorophium bonellii[/i]. Image: Biodiversity Institute of Ontario

(PhysOrg.com) -- Fritz Vollrath and colleagues from Oxford University have been analyzing the gooey material produced by tiny amphipods known as *Crassicorophium bonellii*, a small shrimp-like creature that produces the goo for use as a binding material in building its undersea home. The team has found, as explained in their study published in *Naturwissenschaften*, that the material is a sort of combination between the cement barnacles use to affix themselves to rocks and ship hulls, and spider silk; an interesting combination that if duplicated in an industrial process could lead to beneficial materials for use in medical implantation products.

When making its home, the Crassicorophium processes the goo

internally via a glad similar to that found in barnacles, then pushes it out through little holes in its leg where it is spun into fibers, allowing for great flexibility in its application. The sticky fibers are then used to bind rocks and other seafloor material together to form a shelter in which the Crassicorophium can reside. The binding material is stretchy and strong like spider silk, but also has the cement like qualities of barnacle glue and is impervious to saltwater. In taking a closer look, the team found that its proteins are heavy with glycine, lysine, and aspartic acid, which accounts for the stretchiness and ability to form fibers.

Because the gland used to make the goo is so similar to that found in barnacles and because they are both crustaceans, the researchers suggest that the two creatures likely have a common ancestor. Though it's doubtful the same can be said for Crassicorophium and spiders despite the fact that both produce a type of silk.

In looking at the material made by the Crassicorophium it's easy to start imagining ways it might be used by us humans. A material that isn't bothered by salt water, that is stretchy and strong and will stick to whatever it is attached to for as long as needed, sounds like the perfect stuff for all sorts of medical applications, from sutures to grafts and implants to perhaps even internal casts for helping bones heal. The group also suggests that in studying the goo made by Crassicorophium, it might be possible to learn more about the cement made by barnacles and how it works which could lead to not just ways to keep barnacles off hulls, but in developing new materials for protecting them as well.

More information: A novel marine silk, *NATURWISSENSCHAFTEN*, DOI: 10.1007/s00114-011-0853-5

Abstract

The discovery of a novel silk production system in a marine amphipod provides insights into the wider potential of natural silks. The tube-

building corophioid amphipod Crassicorophium bonellii produces from its legs fibrous, adhesive underwater threads that combine barnacle cement biology with aspects of spider silk thread extrusion spinning. We characterised the filamentous silk as a mixture of mucopolysaccharides and protein deriving from glands representing two distinct types. The carbohydrate and protein silk secretion is dominated by complex β-sheet structures and a high content of charged amino acid residues. The filamentous secretion product exits the gland through a pore near the tip of the secretory leg after having moved through a duct, which subdivides into several small ductules all terminating in a spindle-shaped chamber. This chamber communicates with the exterior and may be considered the silk reservoir and processing/mixing space, in which the silk is mechanically and potentially chemically altered and becomes fibrous. We assert that further study of this probably independently evolved, marine arthropod silk processing and secretion system can provide not only important insights into the more complex arachnid and insect silks but also into crustacean adhesion cements.

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Citation: Shrimp-like crustacean found to make gooey underwater silk (2011, November 23) retrieved 24 April 2024 from https://phys.org/news/2011-11-shrimp-like-crustacean-gooey-underwater-silk.html

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