Fine Structural Characteristics of the Microspheres on the Chorionic Surface of the Orb Web Spider *Trichonephila clavata*

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INTRODUCTION & MATERIALS & METHODS

- The chorionic surface of the golden orb-web spider, *Trichonephila clavata* is covered with a milky-white substance which function is not clearly known. Here we examined the fine structure of egg surfaces to elucidate the function.
- Microscopic images were photographed using Motic digital imaging system and Nikon microscope. Fine structure of egg clusters of *T. clavata* was observed using field emission scanning electron microscopy (FESEM). For transmission electron microscopy (TEM) observation, maternal ovary tissue of *T. clavata* was were examined with a JEM 100 CX-II (JEOL, Japan) electron microscopy at 80 kV.
- Eggs were attached to a flexible cover glass (0.14 mm × 18 mm × 18 mm, Marienfeld, Germany) and were treated for various solvent (distilled water, EtOH, hexafluoroisopropanol) conditions under different times.

RESULT & DISCUSSION

- The white coating in eggmass consists of microspheres with a uniform distribution around 1.85 μm.
- Although the surface of eggmass is seen multi-layered, the spherical coating adheres to the chorion consists of a monolayer. It is observed that MSs were not generated during egg maturation.
- Proteinaceous granular structure secreted together with a sticky (or gluey) substance during the oocyte maturation. Mucus in oviposition fluid attaches to the MSs or chorion and appears to make the surfaces sticky and rough.
- The MSs with water insoluble coating are suitable not only as a physical barrier but also as against moisture blocking.

RESULTS

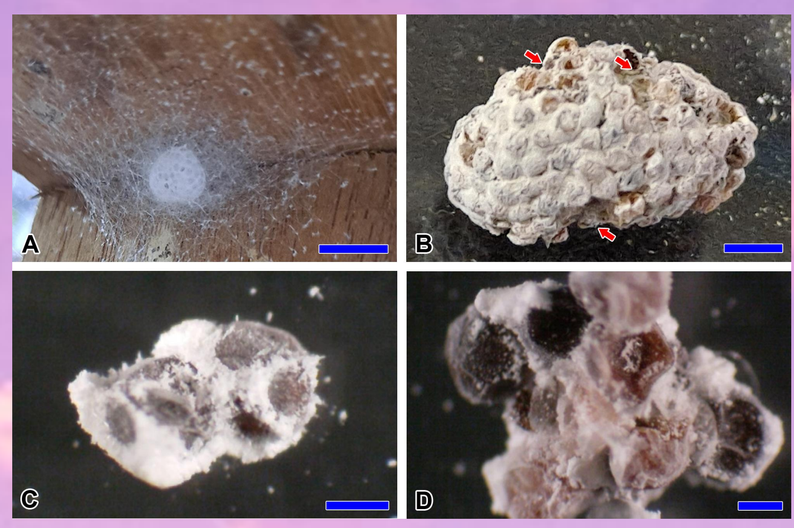

Fig 1. Eggmass of the spider T. clavata. Arrow indicates the inner eggs surface. Each scale bar indicates 1 cm (A), 2 mm (B) and 500 μm (C, D).

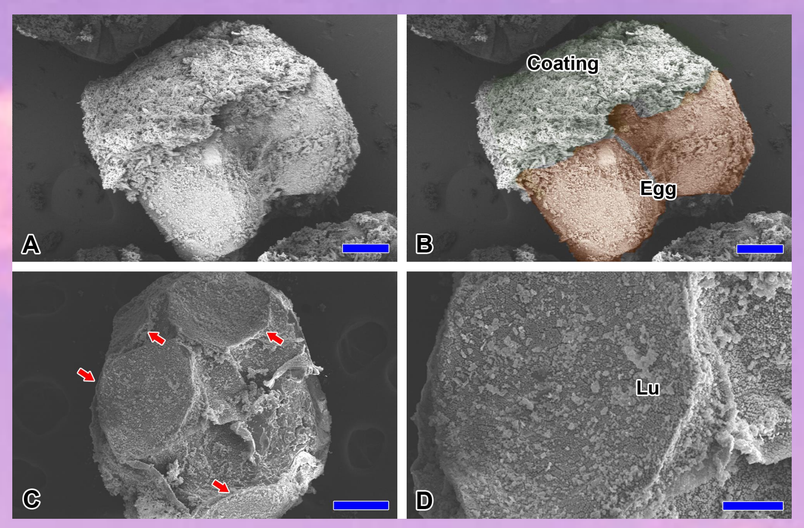

Fig 2. Eggmass coating and egg surface. Egg inside the mass was pressed (arrows) by adjacent eggs. Lu : microspheres lump. Each scale bar indicates 200 μm (A - C) and 50 μm (D).

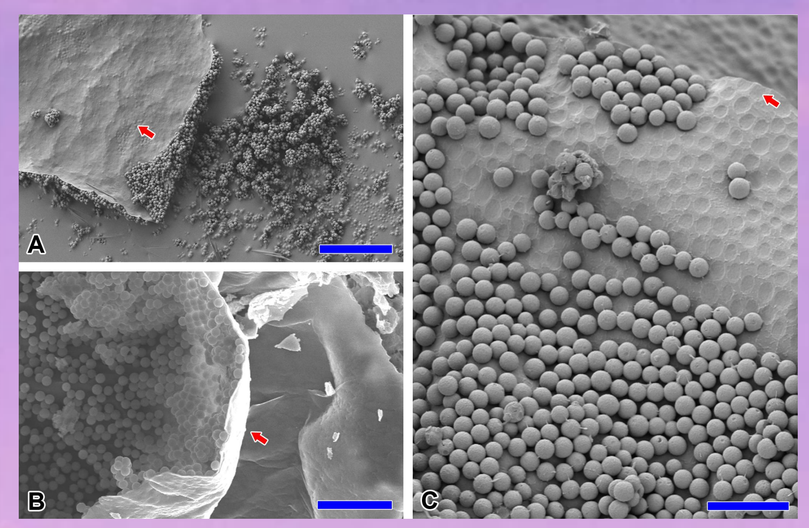

Fig 3. Adhesive chorion surface. A, B : Back side of chorion (arrow); C : Sticky chorion (arrow) front side. Each scale bar indicates 50 μm (A) and 20 μm (B) and 10 μm (C).

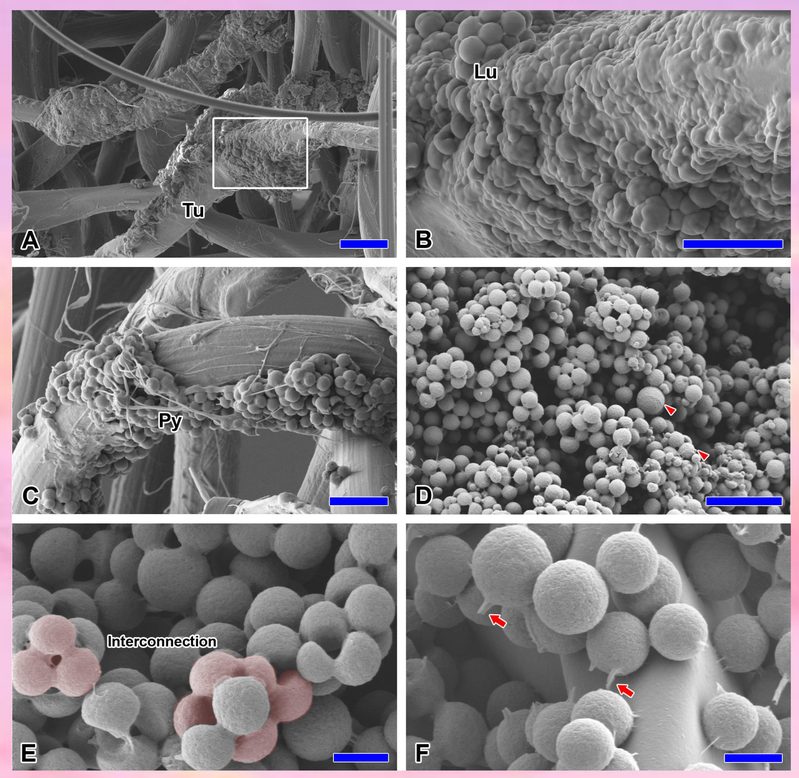

Fig 4. Microspheres in on silk (A - C), on outer surface (D, E), and on inner egg surface (F). White box : B; Tu : Tubuliform gland silk; Py : Pyriform gland silk; Arrow : Papillae. Each scale bar indicates 20 μm (A), 10 μm (B, C, D) and 2 μm (E, F),

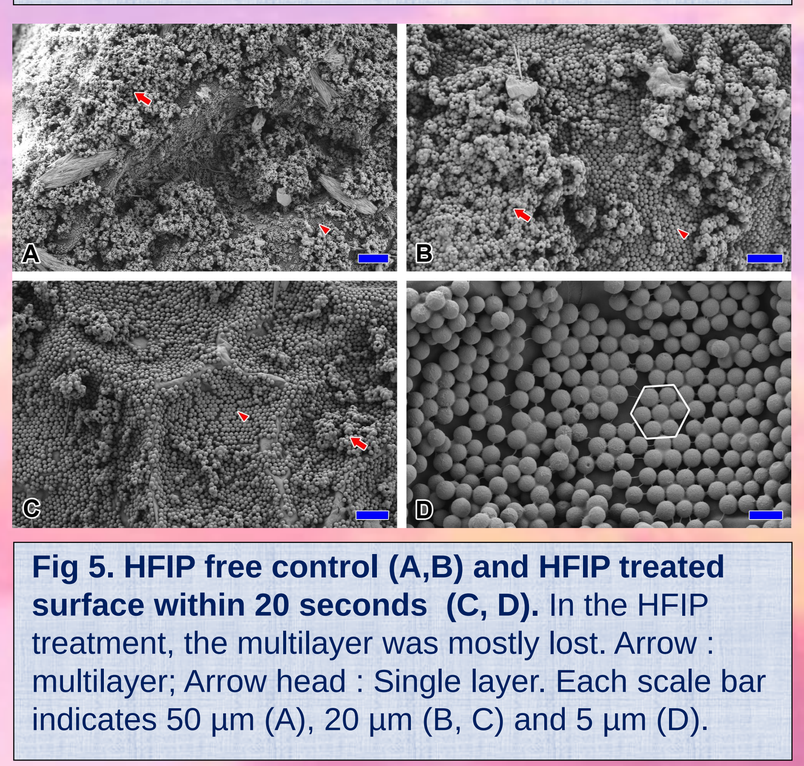

Fig 5. HFIP free control (A,B) and HFIP treated surface within 20 seconds (C, D). In the HFIP treatment, the multilayer was mostly lost. Arrow : multilayer; Arrow head : Single layer. Each scale bar indicates 50 μm (A), 20 μm (B, C) and 5 μm (D).

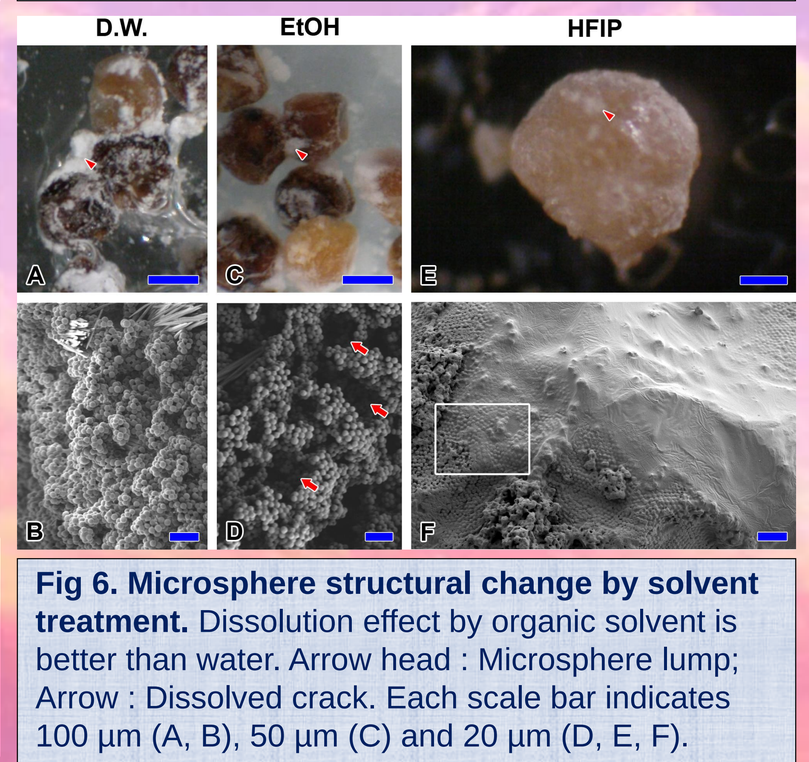

Fig 6. Microsphere structural change by solvent treatment. Dissolution effect by organic solvent is better than water. Arrow head : Microsphere lump; Arrow : Dissolved crack. Each scale bar indicates 100 μm (A, B), 50 μm (C) and 20 μm (D, E, F).

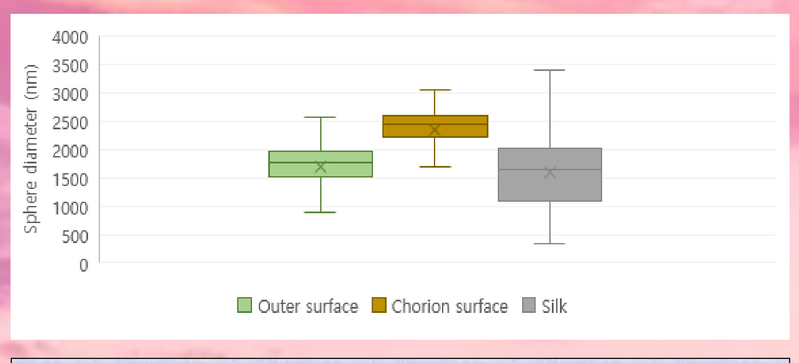

Fig 7. Box plot comparing diameter distribution in outer surface, chorion surface and silk. 500 microspheres each was calculated (Mean : 1692 nm, 2329 nm, 1594nm). ** $p < 0.05$, *** $p < 0.001$.

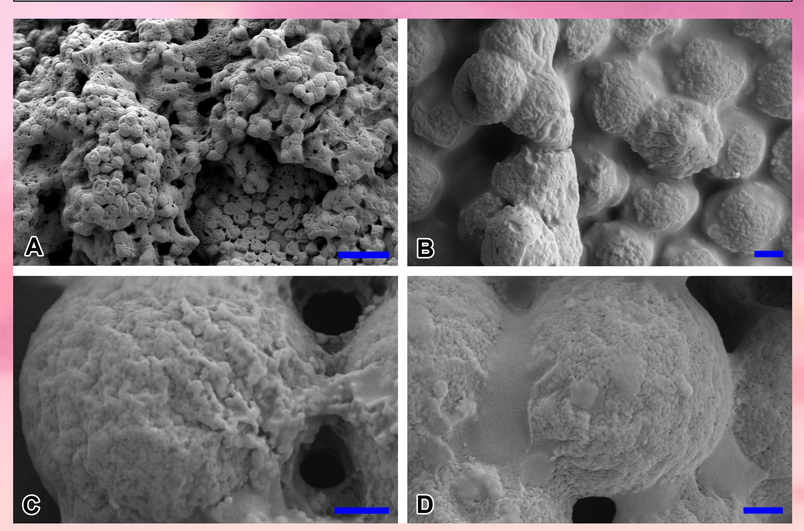

Fig 8. Fine structure of microspheres with HFIP treated. A, B, D : Microspheres melted in HFIP and stuck together; C : Microsphere HFIP free. Each scale bar indicates 10 μm (A), 1 μm (B) and 500 nm (C, D).

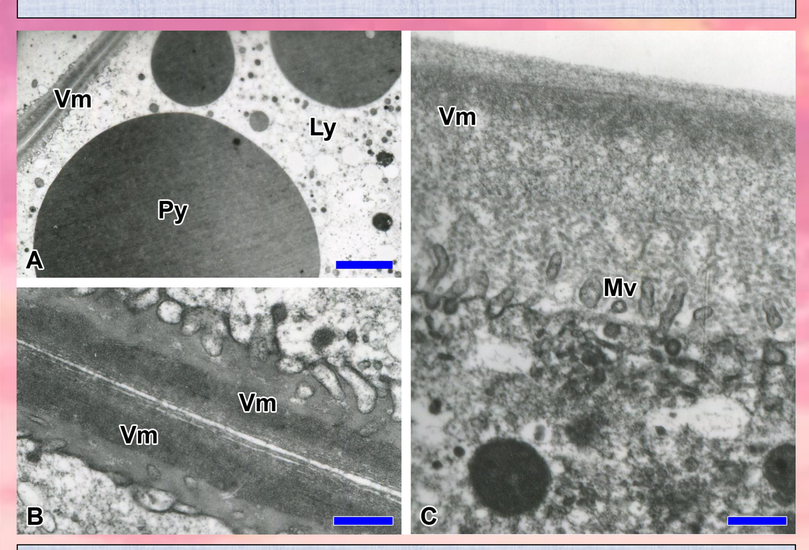

Fig 9. Transmission electron micrograph of the oocyte. No microspheres were observed in the exterior cavity (B) between vitelline membranes (Vm). Py : Proteid yolk; Lu : Lipid yolk; Mv: Microvilli. Each scale bar indicates 5 μm (A) and 500 nm (B, C).

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