

Rose prickles secure their functions in the presence of mechanical failure

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EXTENDED ABSTRACT

Rose prickles are small-scale, plant-based anchoring tools of multifunctional biomechanical roles, combining physical defense against herbivores and growth support on surrounding objects. By employing multiscale structural observations, mechanical testing, and finite element simulations, we unveil that the dog rose (*R. Canina*) prickle incorporates complementary structural-mechanical modifications at different length scales, resulting in macroscopic stress-locking effects that provide the prickle with extreme damage-resistant capabilities—which secure its puncturing, anchoring, and tearing functions after mechanical failures. These novel functional design strategies, unique to plant-based biomechanical tools, may promote micro-engineered material designs for futuristic anchoring platforms.

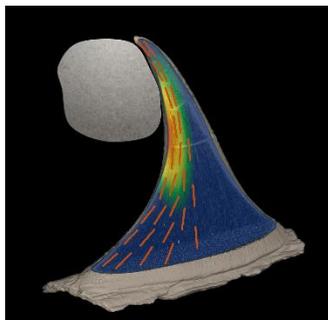


Figure 1: Microtubular morphology and geometrical stress-locking secure the prickle against catastrophic failure.

REFERENCES

Liat Levavi, Benny Bar-On, How do roses build failure-resistant anchoring tools?, *PNAS Nexus*, Volume 3, Issue 12, December 2024, pgae501, <https://doi.org/10.1093/pnasnexus/pgae501>