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Primal Bee: a thermodynamic hive for optimal heat efficiency

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Primal Bee

Honey bee population dynamics are driven by each new generation of brood which develop into workers who fulfill each role allowing the colony to survive and thrive. The cost and effort to grow each new generation of brood has been defined in entomology as the honey to brood equivalence. This can be measured by the quantity of capped food storage available to the colony to produce the equivalent capped brood (next generation) area.

This study, conducted from 2017 to 2024, aimed to develop an internal hive environment which provided honey bee colonies with optimal growth conditions. This was accomplished by applying engineering methodologies to understand i) the dependencies of honey to brood equivalence to the hive design, and ii) to validate the innovative methodology based on new optimal hive design fulfilling the maximization of the honey to brood equivalence in the field.

First, methods were used to assess and measure honey to brood equivalence and rank these for the existing hives designs. Results show that 1) the honey to brood equivalence is no longer to be considered a constant, but a bee/hive combined parameter; 2) the amplitude of advantage for bees is 30% for standard modified hives, rank 200% for innovative hives; 3) the new hive design is fully integrated with the biological needs of honey bees.

Second, pilot tests were put in place in several climatic environments to test the colony
response in optimal hive design. Practical advantages were found for the bees and beekeeper, including early blossom harvest capability, superior population, higher flight activity, higher splitting potential, and superior climate adaptability.

These results provide a fresh perspective demonstrating significant improvements to standard beekeeping methodology resulting in stronger bee populations through enhancement of their hive environment to support their biological processes enabling the colony to overcome challenges while also providing a broad range of economic and operational advantages for beekeepers.