

Primal Bee: A sustainable beekeeping solution for climate challenges

G. Riganti, A. Gamberoni, T. Moldovan, E. Nir, Y. Melman, J.R.Graham

Thermal Balance: The Key to Colony Survival

Honey bees' ability to thermoregulate their hive is a key adaptation for honey bee survival, especially in challenging climates. The ideal internal hive temperature is ~36°C (96°F). Hotter or colder temperatures can negatively impact the queen's egg-laying production and the brood (eggs, larvae, and pupae). The honey bee has several behavioral adaptations to maintain this equilibrium including clustering and vibrating to warm the colony and fanning, ventilating and evaporating water to cool the colony.

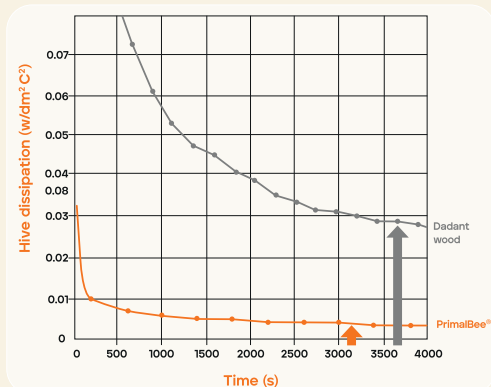


Energy Drain in Traditional Hives

Thermoregulation costs energy needed to fuel water collection flights, fan wings, and thoracic muscles to cluster, vibrate and ventilate within the hive. The efforts of thermoregulation can be lost through dissipation of heat through cracks, seams or thin walls of the standard wooden hive. This can be very energetically expensive for the bees to heat, cool and maintain their hive. Many improvements can be made to the hive design to reduce this energetic cost through thermodynamic engineering and design.

Thermodynamic Advantage: Engineering for the Bees

Since 2015, thermodynamics were compared through quantitative and qualitative measures in the Primal Bee Hive project. Innovative engineering provided an unexplored competitive advantage for honey bees. In a thermodynamic hive, bees expressed increased productivity due to perfect thermoregulation. This advantage created a better incubation process: better temperature control at lower energetic cost. Hive design is fully integrated with the biological needs of honey bees and it is a fully natural solution.



Thermodynamics in the Real World

The PrimalBee nest design was evaluated through extensive research and field testing in diverse climates—including Alaska, Australia, and the Israeli desert—the Primal Bee hive provides a solution to climatic challenges. Its insulative qualities and geometric design reduces heat loss and optimizes heat efficiency. The thermodynamic hive helps mitigate extreme weather impacts on colony health resulting in less honey consumption and larger, healthier honey bee populations.

Austria
Czech Republic
France
Germany
Israel
Italy
Poland
Portugal
Switzerland
United States



Alabama
Alaska
California
Florida
Georgia
Kentucky
Maryland
Massachusetts
Michigan
Mississippi
Missouri
Nevada
New Jersey

New York
Ohio
Oklahoma
Pennsylvania
South Carolina
Tennessee



Texas
Utah
Virginia
Washington



Quantifying the PrimalBee Advantage

Field results have demonstrated significant improvements, including a 500% increase in thermodynamic efficiency in thermodynamic hives compared to standard wooden Landstroth hives (insulated wooden Langstroth hives only increased thermodynamic efficiency by 35%), doubled bee populations and honey production, and reduced colony loss. The Primal Bee hive enhances colony resilience against climate-related stressors while promoting sustainability in apiculture and by bridging scientific innovation with practical beekeeping needs.

Join our newsletter
Hive Mind:



Get in touch:



Jason Graham, Gianmario Riganti, Alessandro Gamberoni, Tomer Moldovan, Assaf Shachar, Yotam Melman, Eitan Nir
Primal Bee

The honey bees' ability to thermoregulate their hive is a key adaptation for honey bee survival, especially in challenging climates. The ideal internal hive temperature is ~36 (96). Hotter or colder temperatures can negatively impact the queen's egg-laying production and the brood (eggs, larvae, and pupae). The honey bee has several behavioral adaptations to maintain this equilibrium including clustering and vibrating to warm the colony and fanning, ventilating and evaporating water to cool the colony. Thermoregulation costs energy needed to fuel water collection flights, fan wings, and thoracic muscles to cluster, vibrate and ventilate within the hive. The efforts of thermoregulation can be lost through dissipation of heat through cracks, seams or thin walls of the standard wooden hive. This can be very energetically expensive for the bees to heat, cool and maintain their hive. Many improvements can be made to the hive design to reduce this energetic cost through thermodynamic engineering and design. Since 2015, thermodynamics were compared through quantitative and qualitative measures in the Primal Bee Hive project. Innovative engineering provided an unexplored competitive advantage for honey bees. In a thermodynamic hive, bees expressed increased productivity due to perfect thermoregulation. This advantage created a better incubation process: better temperature control at lower energetic cost. The Primal Bee nest design was evaluated through extensive research and field testing in diverse climates—including Alaska, Australia, and the Israeli desert—the Primal Bee hive provides a solution to climatic challenges. Its insulative qualities and geometric design reduces heat loss and optimizes heat-efficiency. The thermodynamic hive helps mitigate extreme weather impacts on colony health resulting in less honey consumption and larger, healthier honey bee populations. Field results have demonstrated significant improvements, including a 500% increase in thermodynamic efficiency in thermodynamic hives compared to standard wooden Langstroth hives (insulated wooden Langstroth hives only increased thermodynamic efficiency by 35%). doubled bee populations and honey production, and reduced colony loss. The Primal Bee hive enhances colony resilience against climate-related stressors while promoting sustainability in apiculture. By bridging scientific innovation with practical beekeeping needs, the Primal Bee hive sets a new standard for sustainable beekeeping under climate challenges.