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New insights in the thermal properties of the Dadant bee hives to make them less sensitive to weather condition

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Temperature in the hives is a factor influencing bees behavior, health and the beekeeper's productivity. Various interviews of beekeepers in their apiaries, throughout Europe, provide information on their initiatives to modify their hives for the health of their bees (varroa control, mitigation of climate change). These modifications influence internal hive hygrothermal conditions and raise scientific questions to the researchers: what changes affect hive temperature ? and to what extent ? The hive acts as an "intermediary object", as hive modification practices require discussions and create relationships between beekeepers and others. Scientists, too, are involved to discuss beekeepers' perception of the effectiveness of their innovation on bees, through their beehive instrumentation work. The variations of hive temperatures depend on many factors. As this study focuses on environmental factors, only empty hives are instrumented to assess their thermal properties. Long-term and short-term summer/winter temperature sensor data from various modified Dadant hives provide quantitative information on the amount of energy exchanged with the external environment, e.g. when a roof is painted white, or when an empty, overturned feeder is under the roof (with or without polystyrene), as well as on the reaction time of the hive fitted with aluminium partitions. The results show that the thermal properties of hives, and thus hive temperatures, can be changed in a large extent with minor modifications of the hive. Depending on materials, paints, structures, the sensitivity of the hive temperatures to the solar irradiance and/or external air temperature can be made higher or lower, depending on the beekeeper wish. This knowledge of the changes made to the hives and the control of their internal temperature should enable beekeepers to identify and reduce any thermal stress before it occurs - while minimizing the number of interventions on the apiaries, and move towards more sustainable beekeeping through greater care for the bees, helping them to adapt to climate change.