Effects of Dietary Fatty Acids on Overwintering Success of Honeybees

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Since 2006 the over winter loss of managed honeybee colonies has peaked over 30%, double the acceptable limit. Continued high losses threaten worldwide food security. Over winter bees do not hibernate; they cluster and maintain a core temperature of 33° C, requiring heat made by a high metabolic rate, which can cause body-damaging oxidative stress and reduce longevity. Fewer clustered bees decrease their chance of survival. The aim of this study was to test if dietary saturated and unsaturated fatty acids (FAs) in cell membranes have different metabolic effects, can help reduce oxidative stress and aid colony winter survival. The study consisted a field component, and two laboratory components, each of which incorporated synthetic foods containing variable amounts of coconut oil (saturated FA) and/or soy oil (unsaturated FA). In October 2014, five field colonies were fed coconut oil food, five were fed soy oil food, and five collected naturally available pollen. New emerged bees from each colony were housed in laboratory cages and fed foods with different ratios of coconut and soy oils. Results showed that bees selected from these foods to regulate their intake of the saturated FA. Next, in December 2014 clustered bees were collected from each of the colonies and their thermal tolerance, metabolic rate, and oxidative stress were measured in the lab. Bees from colonies feeding on coconut oil food had increased thermal tolerance with reduced metabolic rate, and decreased oxidative stress levels. Finally, clustered bees collected in January 2015 from colonies fed coconut oil food showed reduced oxidative stress levels. All but two control colonies survived. Colleagues are analyzing bee samples to confirm FA composition of cell membranes.

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