ELUCIDATION BY MASS SPECTROMETRY OF CARBOHYDRATE BIOSYNTHESIS IN AN ENTOMOPATHOGENIC NEMATODE

MICHAEL J. LACEY, QUI LI HONG AND ROBIN A. BEDDING

CSIRO Entomology, GPO Box 1700, CANBERRA, ACT 2601

Entomogenous nematodes such as *Steinernema carpocapsae* are environmentally benign alternatives to chemical insecticides. To ensure commercially viability the nematodes need to be produced in large quantities and need to endure an adequate shelf-life for field application as 'living insecticides'. Thus, long-term storage of *S. carpocapsae* for at least a year has been achieved by CSIRO Entomology by coercing the nematodes into a state of quiescence through a strategy of partial dehydration (anhydrobiosis). During anhydrobiosis enhanced amounts of α,α-trehalose and glycerol are biosynthesised by the nematodes as protectants to supplant the lost water of cell membranes and enzymes.

When a combination of mass spectrometry and isotopic labelling (^{2}H, ^{13}C and ^{14}C) was used to confirm the transport of exogenous molecules into the nematode during anhydrobiotic induction, it was discovered that labels from the exogenous molecules had been incorporated into the endogenous carbohydrates. Subsequent mass spectral studies of the biosynthetic pathways *in vivo* revealed that the carbohydrate protectants were not being derived from stored glycogen but rather unexpectedly from lipids. Conversely, the carbohydrates are converted to glycogen on recovery from anhydrobiotic or thermal stress.

The present results have important implications for foreshadowing the success or otherwise of prolonged storage regimes for entomopathogenic nematodes.