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Molecular property, phyletic evolution and gene expression profile of DNA transmethylase 3 gene in Apis cerana

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DNA methylation is a vital epigenetic modification involved in an array of processes such as genomic imprinting and embryonic development. Here, the molecular property and phyletic evolution were analyzed using bioinformatics tools, followed by detection of spatiotemporal expression profile of Apis ceranaDNA methyltransferase 3 (AcDNMT3) gene as well as the expression pattern of AcDNMT3 in workers' midguts inoculated by two widespread fungal pathogens, Ascosphaera apis and Nosema ceranae. The prediction results showed that AcDNMT3 encoded a 758-amino acid protein with an approximate molecular weight of 88.24 kDa and a molecular formula of C3945H6182N1076O1134S44, and the average hydrophilic index is -0.454. AcDNMT3 may interact with 10 proteins such as adenosylhomocysteinase. DNMT3 from species including A. cerana, A. mellifera, and other insects such as Bombus terrestris, Frieseomelitta varia, and Solenopsis Invicta exhibited four common structural domains (PWWP_DNMT3, ADDz_Dnmt3, Dcm superfamily, and PWWP superfamily) and five common conserved motifs. Phylogenetic analysis indicated that AcDNMT3 was closely related to DNMT3 from A. mellifera. RT-qPCR assay demonstrated that AcDNMT3 was differentially expressed in the eggs, larvae, prepupae, and pupae of workers, with the highest expression level in 8-day-old pre-pupae. Additionally, AcDNMT3 is differentially expressed in adult workers at 1-, 2-, 6-, 12-, 15-, and 18-day-old, with the highest expression level in 1-day-old adult. Differential expression of AcDNMT3 was observed across various tissues, with the highest levels in the antennae and the lowest in the midguts. The expression of AcDNMT3 in the gut of 4-day-old larvae was significantly inhibited at 3 days post inoculation (dpi) with A. apis. Its expression level in the midgut of worker was significantly increased at 2 dpi, 4 dpi, and 5 dpi, but significantly decreased at 3 dpi. Our data indicate that AcDNMT3 is a putative hydrophilic, intracellular, non-transmembrane protein highly conserved across A. cerana and several other insect species, AcDNMT3 may play a key part in the development of A. cerana workers, in the larval response to A. apis infection, and in the adult's response to N. ceranae invasion.