

Expression and function analyses of the hormone signaling genes during soldier differentiation of the termite *Zootermopsis nevadensis*.

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Termites have three distinctive castes (reproductives, workers and soldiers), which are morphologically specialized for their tasks. Especially, cuticular colors or structures are remarkably different among each caste. Soldiers are specialized for colony defense, and have well sclerotized and pigmented mandibles and head capsules compared with those of workers. To know the formation mechanisms of the caste-specific traits is important for understanding termite social evolution. The outer cuticle of each caste is expected to be the result of specific modifications to the cuticular tanning (sclerotization and pigmentation) process, but the origin of those differences have not been resolved. The tyrosine metabolic pathway plays an important role in cuticular tanning in insects. Thus, we hypothesized that this pathway and related hormone signaling were involved in the caste-specific cuticular tanning process. We performed gene expression and functional analyses of some candidate genes during each molt (worker-worker, worker-presoldier, presoldier-soldier) in *Zootermopsis nevadensis*. First, gene expression analysis revealed that some tyrosine metabolic genes were highly expressed just before and after molts to soldiers. Moreover, suppressing expression of *Laccase2* (*Lac2*), which is known to act on both sclerotization and pigmentation in the tyrosine metabolic pathway of some model insects, using RNA interference (RNAi) caused a soldier cuticle with light color and soft nature. Second, expression patterns of the ecdysone and juvenile hormone (JH) signaling genes were likely correlated to those of the tyrosine metabolic genes. RNAi of the ecdysone receptor gene (*EcR*) also produced a soldier cuticle with similar characteristics to *Lac2* RNAi. Knockdown of methoprene tolerant (*Met*), which is a candidate receptor gene of JH, did not change the color of soldier cuticle, but resulted in shorter mandibles and smaller head capsules. Finally, qRT-PCR analysis showed that the ecdysone-synthesis genes were highly expressed during the presoldier stage. These results suggest that soldier-specific cuticular tanning requires quantitative changes in tyrosine metabolic gene expression. Furthermore, at least during the soldier molting process, ecdysone may regulate specific expression levels of tyrosine metabolic genes. We will discuss the evolutionary mechanisms of caste-specific modification through hormone signaling.