Comparative study on pupal defensive behaviors in five species of tenebrionid beetles

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Pupae of Tenebrionidae have protective devices (gin-traps) in the abdomen and exhibit a circular abdominal rotation and a gin-trap closure response to a tactile stimulus. To know general principles and mechanosensory mechanisms of the pupal defensive responses, abdominal movement patterns and distributions of mechanoreceptors were examined in the five species of Tenebrionidae with different morphological characteristics. Pupae of all the species usually showed a rapid abdominal rotation with a species-specific trajectory pattern in an all-or-none fashion. Direction of the rotation always depended on the side of stimulation. Prodding abdominal intersegmental membrane usually evoked a rapid closure and reopen of the gin-traps. Prodding an appendage was generally most effective to induce an abdominal rotation. The same stimulus to an abdominal segment was also effective in the smaller species. The higher tactile sensitivity of the abdominal segments was responsible for the campaniform sensilla (strain sensors) rather than the hair sensilla (touch sensors). The density of the campaniform sensilla in an abdominal segment in the different species was not so different. Thus, the higher mechanical sensitivity of the abdomen in the smaller species may be due to the mechanical property of the cuticle rather than the density of the mechanosensilla.