SIGNIFICANCE OF MEDIUM CHAIN \( n \)-ALKANES AS ACCOMPANYING COMPOUNDS IN HEMIPTERAN DEFENSIVE SECRETIONS: AN INVESTIGATION BASED ON THE DEFENSIVE SECRETION OF *Coridius janus*

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Abstract—A mixture of \( \text{trans-2-hexenal} \) : \( \text{n-tridecane} \) (60:40, w/w), the natural combination present in the defensive secretion of *Coridius janus* (Hemiptera; Pentatomidae) was shown by comparison with similar aldehyde mixtures having longer and shorter chain \( n \)-alkanes, to be the optimal combination as a fumigant and a repellent against three test insect species, *Anoplolepis longipes*, *Sitotroga cerealella*, and *Culex quinquefasciatus*. Toxic values obtained for the three insects, respectively: \( 1/LC_{50} \), 1.72, 4.54, and 6.66 ppm while repellencies were 63\%, 50\%, and 69\%. This study revealed that among \( \text{trans-2-hexenal} \) : \( n \)-alkane combinations those with medium carbon chains, \( \text{viz} \) \( C-11 \) and \( C-12 \), also possessed high toxicities and repellencies comparable to that of the natural combination while those with shorter and longer \( n \)-alkanes possessed lower activity. Toxicities and repellencies of \( n \)-alkane series were only moderate to low showing highest toxic values for \( n \)-tridecane at \( 1/LC_{50} \), 0.39, 2.32, and 2.32 ppm and repellencies at 31\%, 30\%, and 32\% for the three test insects, respectively. This series, nevertheless, showed similar variation, medium length chains, \( C-11 \), \( C-12 \), and \( C-13 \) showing comparatively higher activity than other alkanes of shorter and longer chains. This study also revealed that the fumigant property of both alkane and aldehyde are of equal importance while repellency is heavily dependent on the aldehyde.

Key Words—*Coridius janus*, Pentatomidae, Hemiptera, Defensive secretion, \( n \)-alkanes, acetates, toxicants.

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INTRODUCTION

A self-protective role against their predators as the primary function of insect defensive secretions has been established (Blum, 1964; Peschke and Eisner, 1987; Roth et al., 1956). Often these secretions are multicomponent, presumably relating to their specific function/s described as repellents, deterrents, toxicants, alarm, or aggregation pheromones (Staddon, 1979; Aldrich, 1988). Hydrocarbons are a frequently found in insect defensive secretions with structural diversity ranging from simple n-alkanes to cyclic, mono-, di-, tri-unsaturated, and branched molecules (Weatherston and Percy, 1978). One of the characteristic features of hemipteran defensive secretions is that they often consist of one or more deterrents accompanied by alkanes or acetates (Aldrich, 1988; Eisner et al., 1961; Dettner, 1984). Pentatomidae and Coreidae, the two most thoroughly studied families of Hemiptera conform to the above, possessing simple alkanes and acetates, respectively, as accompanying compounds (Weatherston and Percy, 1978; Weatherston, 1967). Besides serving as solvents that modulate evaporation of volatile irritants, these accompanying compounds act synergistically as spreading and penetrating agents as shown by Staddon (1979) and Remold (1962).

In our previous study, the toxicity of the defensive secretion of Coridius janus Fabricius (Hemiptera; Pentatomidae) was shown toward three household pests: Anoplolepis longipes (Formicidae), Culex quinquefasciatus (Culicidae), and Sitotroga cerealella (Gelechiidae) (Gunawardena and Herath, 1991). A mixture of t-2-hexenal and n-tridecane (60/40, w/w), the two major components of the above secretion was shown to be responsible for the toxic action. Our interest was to examine the effectiveness of the above natural formula against other similar mixtures having longer and shorter chain n-alkanes as accompanying compounds. Is there an optimum chain length for effectiveness? What is the contribution of n-alkanes toward overall toxicity and repellency of the mixture? These aspects of accompanying compounds have not been studied before.

MATERIALS AND METHODS

Chemical Samples and Chemical Analyses

n-Alkanes were purchased from Fluka Chemicals, Switzerland, and t-2-hexenal from Aldrich Chemicals Co. Ltd., U.K. Purity of these chemicals was found to be 99.9% by GLC analysis. Gas Liquid Chromatography was carried out on a Shimadzu GC-6A instrument with FID, a He flow of 30 ml/min., temperature program of 40–225°C at 8°C/min, 240°C detector and injector temperature, glass columns (0.25mm id × 30M; SPB 1 stationary phase fused silica).