INSECTICIDE RESISTANCE AND POSSIBLE RESISTANCE MECHANISMS IN FIELD-COLLECTED GERMAN COCKROACHES, *BLATTELLA GERMANICA* (L.) FROM MALAYSIA

CHOW-YANG LEE, J. HEMINGWAY[1], H. H. YAP & N. L. CHONG
Vector Control Research Unit, School of Biological Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia.
[1]School of Pure & Applied Biology, University of Wales, Cardiff, CF1 3TL, United Kingdom

Insecticide resistance in the German cockroach had never been reported in the South East Asia region. This study characterizes the first resistance profile and possible resistance mechanisms in field collected strains of the German cockroach from Malaysia. Four strains of the German cockroach (R1, R2, R3 and R4) collected from hotels and restaurants, and a susceptible strain (S) were tested topically against several classes of insecticide. Broad spectrum resistance was detected where resistance levels at LD_{50} (RR_{50}) were low to high (7.5 to >62.8×) for carbamates (propoxur and bendicarb), low (2.0 to 4.7×) for the organophosphate (chlorpyrifos) and low to high (4.1 to 52.3×) for pyrethroids (cypermethrin, deltamethrin, permethrin and phenothrin). All strains also demonstrated resistance to DDT.

Possible resistance mechanisms in the resistant strains were characterized using synergists and biochemical assays. Synergism studies with piperonyl butoxide (PBO) and *S,S,S*-tributylphosphorotrithioate (DEF®) suggested the involvement of monooxygenases and esterases in propoxur resistance. However, resistance level in all resistant strains were not affected when cypermethrin and permethrin were synergised with either PBO or DEF®. This indicated possible involvement of a non-metabolic based resistance mechanism (e.g. *kdr*-type) in pyrethroid resistance.

Elevated esterase activities were detected using the model substrates α-, β-naphthyl acetate and ρ-nitrophenyl acetate. Esterase activities correlated well with propoxur resistance levels. Mean estimated gene frequencies (GF) for elevated esterase in the four strains ranged from 0.20 to 0.65. Seven esterase bands (E_1 to E_7) separated on native polyacrylamide gel electrophoresis (PAGE) showed heavier banding intensities on E_1 (R1 and R2 strains), E_5 (R1, R2 and R4 strains) and E_7 (all resistant strains) when compared with those of susceptible strain. Inhibition studies of esterase on native PAGE using selective inhibitors suggested that E_1 belongs to cholineasterase group, while E_5 and E_7 were carboxylesterases.

Altered acetylcholinesterase was detected in all resistant strains at a low frequency (GF=0.03 to 0.08). Elevated glutathione *S*-transferase activities were only detected in two resistant strains (R1 and R4) with GF of 0.17 and 0.68, respectively.

Proceedings of the Second International Conference on Urban Pests.
K.B. Wildey (editor). 1996