

FORCED CONTACT AND ARENA BIOASSAYS TO ASSESS THE PERFORMANCE OF A PYRETHROID WP DEPOSIT AGAINST ORIENTAL COCKROACHES

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Abstract—LT50s and LT95s were determined at 28°C for adult female *Blatta orientalis* over deposit concentrations varying from 15–200 mg AI m⁻² on a plywood surface treated with a WP formulation of cypermethrin. Mortality was determined 3 days following removal from the deposits. Regression equations for these parameters were

$$\text{LT50 (min)} = 31.8 - 11.8 \log [\text{surface concentration (mg AI m}^{-2}\text{)}] \quad (r^2 = 0.896)$$

$$\text{LT95 (min)} = 65.0 - 25.1 \log [\text{surface concentration (mg AI m}^{-2}\text{)}] \quad (r^2 = 0.875)$$

These results were compared with mortalities obtained when the cockroaches were allowed free movement in arenas containing a harbourage and a treated strip of the WP deposit (40 mg/m²) positioned either adjacent to the harbourage, across the centre, or at the far end of the arena with food/water stations placed on the deposit. The arenas were illuminated on a 12:12 photocycle. 50 adult females were introduced into each arena at the start of a light phase and allowed to condition it for 84 h. Treated strips were introduced prior to the start of the subsequent dark phase, and cockroach emergence, distribution and knockdown monitored during this dark phase. Mortality was recorded 3 and 6 days after introduction of the plates. Positioning the deposit either at the harbourage end or the food/water end of the arena gave >95% knockdown within 6–7 h and > 95% mortality at 3 days, consistent with the high proportion of the time which active cockroaches spent in these two locations during the first 3 h of the dark phase. Most of the cockroaches surviving the first dark phase also survived the subsequent 6 dark phases. In control arenas a maximum of 30% of the population was active in the arena at any time during the dark phase, whereas contact with treated strips placed at the harbourage/food and water ends produced a flushing action 2–4 h into the dark phase in which >95% of the population emerged over a period of approximately 1 h. The flushing effect produced faster knockdown and a greater percentage mortality than would have been anticipated on the basis of the forced contact bioassays and initial pattern of emergence.

INTRODUCTION

Formulations of residual deposits of blatticides are often compared during development by forced contact tests on treated surfaces. Such tests do not assess the effect of behavioural contributions to the performance of insecticides such as irritancy and avoidance behaviour, the aggregative behaviour of harbouring cockroaches which may lead to cross-contamination and activation, and the diurnal behaviour of cockroaches which determines their period of exposure to a deposit and provides an opportunity to recover from sub-lethal contacts. These limitations can be partly remedied by conducting laboratory tests using arenas with harbourages, although such tests normally enclose the cockroaches in a much smaller area than their typical foraging range, and the number of experimental variables (arena dimensions, width and position of deposit, photocycle, period of habituation to arena) is increased.

This paper describes a simple arena for determining the performance of a residual pyrethroid deposit to the Oriental cockroach *Blatta orientalis*, and relates 3 day mortalities resulting from exposure to treated plates at three positions in the arena with those produced in forced contact bioassays with varying periods of exposure to the deposit.

MATERIALS AND METHODS

The strain of *B. orientalis* has been cultured at Silwood Park for 5 years at 28°C on a diet of mouse pellets and water supplied *ad lib*. Forced contact and arena tests were carried out in a constant environment room at a temperature of 28° –1°C and an RH of 50% –10%. The room was set to a 12:12 L:D photocycle. Illumination in the light phase was provided by banks of 4 fluorescent

