

**DEVELOPMENT OF A FUMIGATION PROTOCOL FOR
LIQUID PHOSPHINE (2% PHOSPHINE IN 98% LIQUID
CARBON DIOXIDE / ECO2FUME) TO CONTROL RICE
WEEVIL (*Sitophilus oryzae*) IN STORED MILLED RICE**

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ABSTRACT

An experiment was designed to develop a fumigation protocol for liquid phosphine (2% phosphine and 98% liquid carbon dioxide) to control rice weevil (*Sitophilus oryzae*) in stored milled rice and thereby to increase the food safety at the quarantine service in Sri Lanka. The experiment was laid out in a Complete Randomized Design with eight concentration levels of liquid phosphine; 10, 20, 35, 50, 100, 150, 200, and 250 g (equivalent to 140, 280, 490, 700, 1400, 2100, 2800, and 3500 ppm, respectively) with a control treatment. All treatments were replicated three times. Each concentration level was tested under two time regimes (24 and 36 hrs) and 50 same-aged adults were introduced to glass vials with 50 g of milled rice in each. Similarly, other life stages viz. pupae, larvae and egg infested rice, each weighing 50 g, were introduced separately to vials for fumigation. Mortality of *S. oryzae* was recorded soon after the fumigation as well as 1, 4, 7, 14, 21, 28 and 35 d after fumigation. In the eight treatments, except for the control treatment, 100% mortality was recorded in the adult stage, in both time regimes. After 14 d of treatment, all tested concentration levels against pupae of *S. oryzae* showed mean newly emerged adult numbers of 0.67, 0.67 and 0.33 ($P < 0.0001$) at 140, 280 and 490 ppm, respectively, for the 24 hrs time regime and 0.33, 0.33 and 0.67 ($P = 0.053$) at 140, 280 and 490 ppm, respectively, for the 36 hrs time regime. After 28 d, 24 hrs treatment of liquid phosphine concentrations against the eggs of *S. oryzae* recorded a mean newly emerged adult number of 0.67 ($P = 0.003$) at 280 ppm whereas the 36 hrs treatment of liquid phosphine yielded adult numbers of 0.33 and 0.33 ($P = 0.322$) at 140 and 280 ppm, respectively. The lowest concentration and the lowest fumigation time to achieve 100% mortality of all stages of *S. oryzae* was 700 ppm with 24 hrs of fumigation time. Therefore, the concentration level of 700 ppm with 24 hrs of fumigation time can be declared suitable for achieving 100% mortality of *S. oryzae*, as per the present findings.

Keywords: Fumigation, Liquid Phosphine, *Sitophilus oryzae*, Rice