# EFFICACY OF SULFURYL FLUORIDE TO CONTROL HAM MITES AND RED-LEGGED HAM BETTLES

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Methyl bromide (MB) has been the industry standard for rapid killing of all life stages of many insect and mite pests for both fresh and durable high value and value-added agricultural products. Sulfuryl fluoride (SF) has been registered by EPA for numerous postharvest uses, and is being evaluated as an alternative for MB in many cases. Hydrogen phosphide, also referred to as phosphine gas (PH3), is commonly used for pest control in bulk commodities such as grains, nuts and dried fruits. The ongoing world-wide ban on MB as an ozone-depleting substance and the evolution of genetically-based resistance to PH3 in some insect populations has stimulated research on chemical and non-chemical alternatives to these commonly used fumigants. Sulfuryl fluoride (SF), a non-ozone depleting fumigant, recently received registration from the U.S. Environemntal Protection Agency (EPA) for use in durable stored food products and food processing buildings. The EPA label rate maximum for SF use in food storage and processing structures is set at a concentration-time product, CTP, of 1,500 g-hrs per cubic meter (approximately equal to 1,500 oz-hrs per 1000 cubic feet), and the maximum tolerance level for fluoride ion concentration in dried meat is set at 20 ppm. This paper reports recent results of laboratory dose-mortality with SF against life stage of the ham mite, *Tyrophagous putrescentiae* (Acarina: Acaridae) and the red-legged ham beetle, *Necrobia rufipes* (Coleoptera: Cleridae), both of which are serious pests of the southern dried-cured ham industry in the United States.

Fumigation experiments were conducted using 3.8 l gas-tight glass chambers treated with various concentrations of SF at 23 degrees C for 48 and containing various numbers and life stages of the target pests. Experimental concentrations of SF varied from 0.5 to over 100.0 g/m$^3$ in experiments conducted over a 5-month period at controlled laboratory conditions. Life stages tested included eggs and a mixture of adults and nymphs of the ham mite, *T. putrescentiae*, and eggs, large larvae, pupae and adults of the red-legged ham beetle, *N. rufipes*; accumulated sample sizes were over 50 individuals in all cases for most concentrations tested. The concentration for the maximum label rate of SF during 48 hrs in these tests was about 31.2 g/m3. We achieved 100% mortality of adult and pupae of *N. rufipes* at about 4.0 g/m$^3$, whereas 100% mortality of larvae was achieved at about 5.7 g/m$^3$. Mortality of *N. rufipes* eggs occurred at about 24.0

$g/m^3$ of SF, well below the 1,500 CTP maximum label rate for the 48-hr treatment. Ham mites proved more difficult to kill with SF than were red-legged ham beetles. Mixed adults and nymphs of *T. putrescentiae* were killed at 100% under a concentration of about 100.3 $g/m^3$, and mortality of eggs at this same concentration was approximately 95%. This effective concentration for killing ham mites at 23 C in 48 hrs was about three times greater than the maximum allowable label rate of 1,500 CTP. Thus, SF may not be an effective fumigant for practical control of ham mites under these conditions.

Future research will investigate other MB alternatives to control ham mites and red-legged ham beetles. These alternatives include phosphine gas, PH3, low oxygen atmospheres, and application of ozone, in laboratory trials.