

Title Evaluation of new silica based insecticide formulations as protectant of stored products at higher relative humidities

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Abstract

Different silica products with surface modifications regarding their hydrophobicity were compared with the commercial product Fossil Shield® FS90.0s. Experiments were conducted in petri dishes with *Sitophilus granarius* and *Sitophilus oryzae* at 90% relative humidity and 25°C. Mortality and weight of the beetles were recorded over time. The mortality rate was determined after 1, 2, 4, 7, 14, and 28 days, respectively. The highest mortality in trials was achieved with a new hydrophobic formulation (98% for *S. zeamais*, 93% *S. granarius*) after 48 hours. The results of this study indicate that silicas can effectively control *Sitophilus species*. Apparently, the hydrophilic formulations failed to control the beetles sufficiently. At higher dosages all materials resulted in a higher beetle mortality rate. The poor performance of some substances supports the fact that hydrophilic substances saturate with water from the surrounding air and lose their insecticidal efficacy quickly. Generally, the application products consisting of smaller particles resulted in a higher mortality rate than the use of silicas with larger particles. Although current commercial silica products are considerably more effective than older formulations, inert dusts applied to stored products often fail under higher relative humidity, especially when insect pests can uptake water with their diet. One possibility for reducing these problems is to use low rates of conventional chemicals or bioactive botanicals combined with the silica. We investigated the effects of two new silica formulations with surfaces of 800m²/g combined with the monoterpenoids, eugenol and cinnamaldehyde against the stored product pests *Sitophilus granarius* and *Sitophilus oryzae*. Mortality rate of both pest species increased when silicas were applied to food commodities previously treated with a monoterpenoid. In admixture experiments, the toxicity of both silicas was significantly increased ($p < 0.001$). Both substances combinations showed a synergistic effect considering their efficacy based on the LD50-value. Additionally to contact insecticidal affects both monoterpenoids showed a strong fumigant action.