The Impact of Rodeo, Glyphosate, and POEA on *Daphnia magna*

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Recent studies suggest that Glyphosate based herbicides (GBHs) are more harmful to animals than suggested by the EPA and industry funded studies. Glyphosate (GLY) is the most commonly used herbicide in the world and was reclassified as a "probable carcinogen" in 2015 by the International Agency for Research on Cancer. Although GLY is the active ingredient in GBHs, inert ingredients in GBHs are also suspected to be hazardous. Polyethoxylated tallow amine (POEA) is the only disclosed inert ingredient in GBHs and has been shown to be harmful to animals. POEA is a surfactant that allows GLY to penetrate plant cuticles. We hypothesize that POEA, GLY, and Rodeo®, an aquatic GBH, will have negative impacts on the survival and heart rate of adult *Daphnia magna*. Because it is a filter feeder and transparent, *D. magna* is a model organism for toxicological studies. In survival rate studies, Daphnia were exposed in test tubes to mimic their natural environment. In heart rate experiments, daphnia held in microtiter wells were digitally analyzed using slow motion video. In survival rate experiments, daphnia exposed in test tubes to Rodeo® died within 37 minutes at 100% and 200% of the recommended concentration (RC) which contained 5.38% GLY, and 21 hours at 10% and 5%. The 1% group had no effect on survival rate. Death occurred within 21 hours for concentrations ranging from 30%-5% of the 2% GLY stock. Concentrations ≤3% showed no increased mortality when compared to controls. No differences in survival rates were observed between controls and GLY groups. Daphnia exposed to POEA died within 8 hours at 100% of the RC and 48 hours at 1%-50%. Daphnia exposed to 50% of the POEA RC and GLY stock died within 8 hours. All remaining concentrations, ranging from 1%-100%, died within 24 hours. In the heart rate experiments, all Rodeo® concentrations affected daphnia in a dose response pattern. Rodeo® concentrations of 100% and 200% of both the RC and 2% GLY stock as well as 50% of the RC, reduced heart rates by ~50% after 45 minutes. Concentrations of <50% RC of the 2% GLY stock and <25% of the recommended stock had no pronounced effect on daphnia heart rates. GLY did not affect the heart rates of the daphnia. POEA did not cause dramatic changes in daphnia heart rates, and heart rates did not follow a clear dose response pattern. However, daphnia exposed to higher concentrations of POEA had heart rates of <50% of the control, while lower concentrations of POEA trended close to the control. POEA and GLY together did not cause any change to daphnia heart rates; heart rates did not follow a dose response pattern, and the control heart rates were ~50% as fast as the controls of our previously published heart rate experiments. These results suggest a possible synergistic effect of POEA and GLY, since together they had a greater impact on the survival rate than separately. The heart rate experiments suggest that there are ingredients in Rodeo® other than POEA and GLY that affect the heart rates of *D. magna*, since GLY and POEA together yielded less severe results than the full Rodeo® product.