JOINT EFFECTS OF DENSITY DEPENDENCE AND TOXICANT EXPOSURE ON THE LIFE HISTORY AND POPULATION GROWTH RATE OF *DROSOPHILA MELANOGASTER*

Gui Yue

Submitted for the Degree of MSc by research

September 2005

Centre for Ecology, Evolution, and Conservation

School of Environmental Sciences

University of East Anglia

JOINT EFFECTS OF DENSITY DEPENDENCE AND TOXICANT EXPOSURE ON THE LIFE HISTORY AND POPULATION GROWTH RATE OF *DROSOPHILA MELANOGASTER*

Gui Yue

September 2005

Risk assessment of environmental contaminants is usually based on experiments on well fed individuals held at low population densities. However, field populations are often in competition for resources. Density and toxicants individually have negative effects on population growth. However, recent laboratory or simulation studies have shown that toxicant-related mortalities could reduce competition for resources, which could buffer the effects of toxicant on population growth. This study examines the joint effects of toxicant and food availability on populations of *Drosophila melanogaster*. Populations were initiated with 40 newly hatched larvae, and the responses of populations on pupation rate, adult eclosion rate, female thorax length and development time to six toxicants (cadmium, copper, diflubenzuron, fenoxycarb, nicotine and DDT) under limited, intermediate and adequate food levels in the laboratory condition were examined. The interactions between toxicant exposure and food availability

on life-history traits were dose and time dependent. Both compensatory and synergistic interactions between density and toxicity could occur for the same contaminant, depending upon toxicity mechanisms. Toxins lead to larval mortality, reduced female size and extended development time. A population model indicated that the proportion of individuals successfully eclosing was the most important determinant of population growth rate (PGR). Assuming reproductive output was only determined by thorax length, PGR generally decreased at adequate food level with increasing toxicant concentration in all experiments. But when the amount of food available initially was limiting, toxicant exposure often had a lower proportional impact than at higher food levels. The results of this study could be important to population-level toxicant ecological risk assessment.