Development Time and Pupation Behavior in the *Drosophila melanogaster* Subgroup (Diptera: Drosophilidae)

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This study is an in-depth analysis of intersexual, intraspecific, and interspecific variability in larvopupal developmental time, pupation site preference, and larval and pupal survival of a number of isofemale lines of the species *Drosophila mauritiana*, *D. melanogaster*, *D. sechellia*, *D. simulans*, *D. teissieri*, and *D. yakuba*. There was no significant sex differences in pupation height, but females eclosed significantly earlier than males in all species. In addition, the suggestion of a strong negative correlation between larval developmental time and pupation height could not be confirmed in this study. The hypothesis that differences in pupation height provide a basis for niche partitioning between closely related species with overlapping distributions was tested by three planned orthogonal contrast analyses of variance. First, the two species *D. teissieri* and *D. yakuba*, with largely overlapping distribution, were significantly different in pupation height. Second, the two allopatric, nonoverlapping island species *D. mauritiana* and *D. sechellia* did not significantly differ in pupation height. However, the absence of a significant difference in the final contrast between the two cosmopolitan species *D. melanogaster* and *D. simulans*, which are often found together, makes us cautious to accept the hypothesis.

KEY WORDS: *Drosophila melanogaster* subgroup; development time; pupation behavior.

INTRODUCTION

In *Drosophila*, the choice of a suitable pupation site directly influences the successful emergence of the adult (Sokolowski, 1985; Rodriguez et al., 1992).

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Previous studies show that differences in pupation height, a continuous measure of pupation site preferences, are influenced by the abiotic factors moisture, lighting conditions, and temperature and by the biotic factors density, sex, developmental time, and species measured (for reviews, see Sokolowski, 1985; Sokolowski et al., 1986).

Pupation site choice by Drosophila larvae could provide a basis for larval habitat choice and niche separation between species. Schnebel and Grossfield (1986) have done the only systematic study of interspecific variability in pupation behavior in Drosophila. They found significant differences between the two most closely related species in four species triads, each triad coming from a different ecosystem ranging from desert to tropical rain forest. Earlier, Markow (1979) observed that D. melanogaster pupated higher than its sibling, D. simulans, and that D. pseudoobscura, a more distantly related species, pupated higher than D. simulans but lower than D. melanogaster. This, and Schnebel and Grossfield's (1986) findings, strongly suggests the presence of niche separation among closely related Drosophila larvae.

The present study is a systematic study of intersexual, intraspecific, and interspecific variability in pupation behavior and developmental times in the D. melanogaster subgroup. The phylogenetic relationship among the members of the D. melanogaster subgroup has recently been considered in detail using genetic information from all available sources (Lachaise et al., 1988; Singh, 1989). We first addressed the question of effects of sex on pupation height and tested the hypothesis that if pupation height is related to development time, fast developers should pupate in different locations than slow developers. Subsequently, we tested the hypothesis that among species that are sympatric, if larval behavior is important ecologically, pupation heights should differ. Two species pairs from the D. melanogaster subgroup are distributed sympatrically: first, the well-known sibling species pair D. melanogaster and D. simulans, which are cosmopolitan, are generalists, and occur together in many places; and second, the closely related species D. teissieri and D. yakuba, which are generalists and overlap with regard to their distributions on the African mainland and the host plants exploited by their larvae (Lachaise et al., 1988). The alternative hypothesis, that among species that are allopatric, pupation heights should not differ, was tested with the closely related species pair, D. mauritiana and D. sechellia. They live allopatrically on the island of Mauritius and the islands of Seychelles, respectively. Drosophila sechellia breeds on the fruits of the rubiaceous shrub Morinda citrifolia (Lachaise et al., 1988; Legal et al., 1992). Drosophila mauritiana is widespread all over Mauritius and is an abundant, broad-niched, opportunistic, and domestic species (Lachaise et al., 1988). The two species are allopatric to their most closely related relatives D. simulans and D. melanogaster.