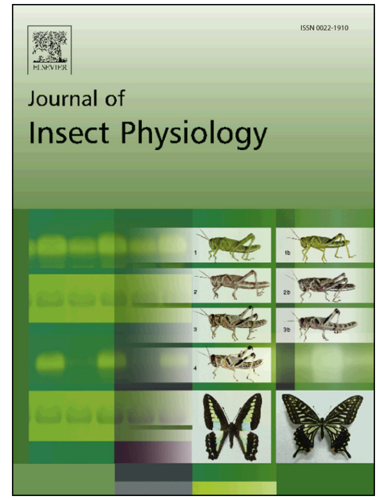
Accepted Manuscript



Fruit flies may face a nutrient-dependent life-history trade-off between secondary sexual trait quality, survival and developmental rate.

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PII: S0022-1910(17)30197-X
DOI: https://doi.org/10.1016/j.jinsphys.2017.11.010
Reference: IP 3730

To appear in: *Journal of Insect Physiology*

Received Date: 3 May 2017
Revised Date: 28 November 2017
Accepted Date: 30 November 2017

Please cite this article as: Gray, L.J., Simpson, S.J., Polak, M., Fruit flies may face a nutrient-dependent life-history trade-off between secondary sexual trait quality, survival and developmental rate., *Journal of Insect Physiology* (2017), doi: https://doi.org/10.1016/j.jinsphys.2017.11.010

Title

Fruit flies may face a nutrient-dependent life-history trade-off between secondary sexual trait quality, survival and developmental rate.

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Abstract

Optimal life-history strategies are those that best allocate finite environmental resources to competing traits. We used the geometric framework for nutrition to evaluate life-history strategies followed by *Drosophila melanogaster* by measuring the condition-dependent performance of life-history traits, including the morphology of male secondary sexual characters, sex combs. We found that depending on their rearing environment flies faced different forms of trait trade-offs and accordingly followed different life-history strategies. High-energy, high-carbohydrate, low-protein diets supported development of the largest and most symmetrical sex combs, however, consistent with handicap models of sexual selection these foods were associated with reduced fly survival and developmental rate. Expressing the highest quality sex combs may require secondary sexual trait quality to be traded-off with developmental rate, and our results indicated that flies unable to slow development died. As larval nutritional environments are predominantly determined by female oviposition substrate choice, we tested where mated female flies laid the most eggs. Mothers chose high-energy, high-protein foods associated with rapid larval development. Mothers avoided high-carbohydrate foods associated with maximal sex comb expression, showing they may avoid producing fewer 'sexy' sons in favour of producing offspring that develop rapidly.

Key words

Drosophila melanogaster, life-history, nutrition, sexual selection, geometric framework

Introduction

Optimal life-history strategies are those that best allocate finite resources to competing traits, and manage potential trade-offs to maximise fitness (Calow, 1982; Stearns & Koella, 1986; Arendt, 1997; Kokko, 1998; Roff & Fairbairn, 2007; Zeller & Koella, 2016). Two strategies animals can follow to maximise their fitness are, 1)