

An Experimental Study of the Mortality Factors of Larval *Musca autumnalis* DeGeer

Author: Ivan Valiela

Source: *Ecological Monographs*, Vol. 39, No. 2 (Spring, 1969), pp. 199-225

Published by: Ecological Society of America

AN EXPERIMENTAL STUDY OF THE MORTALITY FACTORS OF LARVAL *MUSCA AUTUMNALIS* DEGEER¹

IVAN VALIELA²

Section of Ecology and Systematics, Cornell University, Ithaca, New York

TABLE OF CONTENTS

INTRODUCTION	199	Introduction	206
THE APPROACH	199	Methods	207
THE EXPERIMENTAL SUBJECT: <i>Musca</i> <i>autumnalis</i> DEGEER	200	Results	207
EVALUATION OF EGG AND LARVAL MORTALITY:		PARASITISM	210
THE PROBLEM	201	PREDATION BY INVERTEBRATES	210
INTRODUCTION	201	Introduction	210
METHODS	201	Methods	210
RESULTS	202	Results	212
MORTALITY FACTORS FOR EGGS AND LARVAE OF		Overall Effects of Predation	212
FACE FLY: EXPERIMENTAL ANALYSIS	203	Effects of Varying Prey and Predator Densities	212
TEMPERATURE	203	Effect of Prey Age and Size on Predation	214
Introduction	203	PREDATION BY VERTEBRATES	215
Methods	204	LARVAL MORTALITY IN THE FIELD:	
Results	204	THE SYNTHESIS	216
MOISTURE CONTENT OF DUNG	205	SOME PROBLEMS AND COMMENTS ON THE	
Methods	206	EXPERIMENTAL APPROACH AS APPLIED	
Results	206	IN THIS STUDY	218
PH	206	SUMMARY	219
COMPETITION FOR FOOD	206	ACKNOWLEDGMENTS	220
		LITERATURE CITED	220

INTRODUCTION

THE APPROACH

The experimental approach to problems in insect population dynamics in the field has long been used but seldom has its full potential been exploited. Fuller (1934), in a now classic paper, reports on results of field manipulations of densities of blowfly larvae and available food, showing the importance of competition and predation. Additional mortality factors such as temperature, later shown to be of importance (Waterhouse, 1947), were not considered. Other attempts at constructing complete budgets of population mortality have been made since. One of the most notable is the work on the chrysomelid *Phytodecta olivacea* (Richards and Waloff, 1961). Those factors which could be measured directly from the populations, such as parasitism and egg inviability, were carefully studied. Only predation mortality was estimated independently using serological techniques. Although predation turned out to be the main factor contributing to mortality, competition and specific environmental factors could not be isolated and hence their importance remained unevaluated.

The studies of the mortality patterns of the cabbage aphid, *Brevicoryne brassicae* (Hughes, 1963) and the cabbage root fly, *Erioschia brassicae* (Hughes and Mitchell, 1960), are representative of other studies which used the correlative approach. Life tables were obtained and field population data were manipulated providing a partitioning of observed mortality into various components.

Probably the most ambitious effort at developing predictive schemes rather than merely descriptive models is the Canadian work on forest lepidoptera (Morris, 1963a, b; Embree, 1965).

Life tables were used extensively to evaluate overall mortality along with experimental evaluation of some of the mortality factors. Field populations were also examined using the key factor approach (Varley and Gradwell, 1960; Morris, 1963b). This approach is a form of logarithmic multiple regression which can be used to evaluate the contribution of mortality at each age interval to population change. Unfortunately, important mortality factors were evaluated using correlational techniques which inherently fail to provide a causal basis for conclusions. Further the large error in sampling budworm populations in particular and field populations in general, and the lack of accounting for all probable potential mortality factors are such that failure to find evidence for the

¹ Manuscript first received June 21, 1968. Accepted for publication February 22, 1969.

² Present address: Department of Zoology, Michigan State University, East Lansing, Michigan 48823