

**Biology and Ecology of the Leafroller (*Sylepta derogata* Fabricius) on  
Okra  
(*Abelmoschus esculentus* (L.) Moench)**

**By**

**JOYCE IGUNMA IYAMU**  
**B.Sc. (Zoo), M.Sc. (Entomology) Ibadan**  
**Matriculation Number - 26215**

**A Dissertation in the Department of Crop Protection and  
Environmental Biology, Submitted to the Faculty of Agriculture  
and Forestry in Partial Fulfilment of the Requirements for the  
Degree of Master of Philosophy of the University of Ibadan.**

**JULY, 2012.**

## ABSTRACT

*Sylepta derogata*, Fabricius a major insect pest, defoliates and causes enormous yield loss in *Abelmoschus esculentus* (L) Moench. Control of the pest with chemicals and other methods have not been successful due to scanty information on the biology and ecology of the pest. This study was conducted to assess the biology and ecology of *Sylepta derogata* on *Abelmoschus esculentus*.

*Abelmoschus esculentus* was planted in early (March-June, 2009), mid (July-September, 2009) and late (November 2009-January,2010) seasons at the Crop Garden of the Department of Crop Protection and Environmental Biology, University of Ibadan, Nigeria. The experiment was laid out in Randomized Complete Block Design in four replicates. Larval population of *S. derogata* was estimated on 23 randomly selected plants/replicate. Data were collected on temperature, rainfall, relative humidity and percentage field infestation. Leaves of weeds around the experimental plot were observed for habitation and damage by *S. derogata*. Observations were made on the presence of natural enemies on *S. derogata* in the field and identified in the laboratory. The life cycle of *S. derogata* was investigated in the field under natural weather conditions of 22°C-31°C, 39-90% relative humidity and mean rainfall of 2.8 mm. In the laboratory, assessment was done under room temperature of 24°C-28°C and 79-92% relative humidity, on the reproductive biology, development and morphometrics of immature stages of *S. derogata*. Data were analysed using descriptive statistics, correlation and ANOVA at P=0.05.

The field population of *S. derogata* larvae was highest in November and December with 96.2% larval infestation while it was lowest in July and August with 16.1% and 11.3% infestation respectively coinciding with the highest fruit yield. A significant (P=0.05) inverse relationship was observed between *S. derogata* abundance; and each of rainfall ( $r = -0.80$ ) and temperature only ( $r = -0.85$ ) in early season, rainfall ( $r = -0.28$ ) and temperature ( $r = -0.17$ ) in mid-season and temperature ( $r = -0.73$ ) in late season when rainfall receded. However, a significant (P=0.05) direct relationship was observed between *S. derogata* abundance and relative humidity at the late season planting ( $r = 0.18$ ). The mean developmental period from egg to adult was 28 days. The life cycle consisted of egg, five larval stages, pre-pupa, pupa and adult stages. The mean oviposition period was

2 days. The head capsule width ranged from 0.2mm in the first instar to 2.1mm in the fifth instar. The growth index of 1.8 recorded did not conform to Dyar's rule of 1.4. The females were significantly larger in size than the males. The sex ratio was 1.5:1 (male: female). *Apanteles sp* was the natural enemy identified on *S. derogata* which could be used as biological control agent of the larval stages of *S. derogata*, while the alternative host plant was *Solanum nigrum*.

Late season planting of Okra requires control measures. *Apanteles sp* can be used in the control of *S. derogata* on okra. The short developmental period of *S. derogata* indicates the possibility of this pest completing two generations on okra during the growing season thereby increasing the larval population and leaf damage.

Keywords: *Sylepta derogata*, *Abelmoschus esculentus*, Plant host range, *Apanteles sp*.

**WORD COUNT: 495**

## **CERTIFICATION**

I certify that this work was carried out by Joyce Igunma IYAMU in the Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan, Nigeria.

---

Supervisor  
F.K. Ewete  
B.Sc., Dip C.P., M.Phil., Ph.D Ibadan  
Professor of Entomology  
Department of Crop Protection and  
Environmental Biology  
University of Ibadan.

UNIVERSITY OF IBADAN

## **DEDICATION**

This work is dedicated to “I AM THAT I AM” in whom I can confidently say “I am what I am by Grace.

UNIVERSITY OF IBADAN

## ACKNOWLEDGMENTS

I acknowledge with immense gratitude the guidance, fatherly counsel and constructive criticisms of my supervisor, Professor F.K. Ewete. Thank you, sir. I am also grateful to Drs. A.A. Omoloye, R.O. Awodoyin and K.O. Oluwasemire for their criticisms as members of my supervisory committee.

For the opportunity to pursue this research work and lessons so learnt while training in the Department of Crop Protection and Environmental Biology. I am highly grateful to the entire staff and students of this great Department, from whom at various times I had something to benefit. I am also very grateful to the incumbent Dean of the Faculty of Agriculture and Forestry, University of Ibadan, Prof. E.A. Aiyelari and the Head of Department of Crop Protection and Environmental Biology Prof. A.O. Togun for all their encouragements.

Special thanks go to Ms A.O. Oke and Messrs I.A. Olowu and Victor Adaigbe for their technical assistance given to me in the course of this work. I want to thank God for my husband Pastor Nosakhare Patrick Iyamu for all his love, supports (spiritual and financial) and encouragements; and taking care of my home while I was away during this study.

I appreciate my children Ihoghosa, Osaigbovo, Osaretin and Imuentinyan all of University of Benin for their prayers, and technical support. Also my special thanks for my niece Osayi Evelyn for being a child and a Big Sister to my children.

Lord, I give you all the glory, honour, adoration and praises without any reservation, for from you all knowledge, wisdom and understanding came. I am forever indebted to you for your unconditional love and your sustaining grace upon me.

## TABLE OF CONTENTS

Title Page	i
Abstract	ii
Certification	iv
Dedication	v
Acknowledgment	vi
Table of Contents	vii
List of Tables	x
List of Figures	xi
List of Plates	xii
List of Appendix	xiii
<b>CHAPTER ONE: INTRODUCTION</b>	<b>1</b>
<b>CHAPTER TWO:</b>	
2.0 <b>LITERATURE REVIEW</b>	3
2.1 Insect Pests of Okra	3
2.2 Biology and Description of <i>Sylepta derogata</i>	5
2.3 Natural enemies of <i>Sylepta derogata</i>	8
2.4 Control of Insect pests of Okra	9
<b>CHAPTER THREE:</b>	
3.0 <b>MATERIALS AND METHODS</b>	13
3.1 Study Sites	13
3.2 Experimental Units	13
3.3 The Ecology of <i>Sylepta derogata</i> in Ibadan, Nigeria	17

3.3.1	Estimation of Field Infestation by <i>Sylepta derogata</i>	19
3.3.2	Field Parasitism and Predation of Immature Stages of <i>S. derogata</i>	19
3.4	Laboratory Biology of <i>S. derogata</i> in Okra	19
3.4.1	Insect culture	20
3.4.2	Reproductive Biology of <i>Sylepta derogata</i> under ambient conditions	22
3.4.3	Reproductive Biology of <i>Sylepta derogata</i> under laboratory conditions	22
3.5	Studies on Developmental Biology	23
3.6	Determination of the longevity of mated and unmated males and females	24
3.7	Studies on behavioural biology	25
<b>CHAPTER FOUR: RESULTS</b>		
4.1	Seasonal Abundance of <i>S. derogata</i>	26
4.2	The Natural Enemies of <i>S. derogata</i>	45
4.3	Alternative host of <i>S. derogata</i>	47
4.4	Reproductive Biology of <i>S. derogata</i> (longevity and fecundity)	47
4.5	Developmental Biology of <i>S. derogata</i>	49
4.5.1	Egg	49
4.5.2	Larvae	49
4.5.3	Pre-pupa	49
4.5.4	Pupa	49
4.5.5	Adult	50
4.6	Morphometrics of <i>Sylepta derogata</i>	56
4.7	Behavioural Biology of <i>S. derogata</i>	63
4.7.1	Courtship and Mating Behaviour	63



4.7.2 Larval feeding activity	63
<b>CHAPTER FIVE: DISCUSSION</b>	<b>65</b>
<b>SUMMARY AND CONCLUSION</b>	<b>68</b>
<b>REFERENCES</b>	<b>69</b>
<b>APPENDIX</b>	<b>72</b>

UNIVERSITY OF IBADAN

## LIST OF TABLES

Tables	Page
Table 4.1: Relationship between weather parameters, and field infestation (Early season planting)	31
Table 4.2: Relationship between weather parameters, and field infestation (Mid-Early season planting)	32
Table 4.3: Relationship between weather parameters, and field infestation (Late- season planting)	33
Table 4.4: Mean effect of seasons on field infestation and larval population	36
Table 4.5: Mean number of fruits / block/ season	37
Table 4.6: Longevity of mated and unmated males and females of <i>Sylepta derogata</i>	48
Table 4.7: Mean developmental period and morphometrics of different life stages of <i>Sylepta derogata</i>	51
Table 4.8: Head capsule width and growth rate of the larval instars of <i>Sylepta derogata</i>	60
Table 4.9: Head capsule width for larval instars and t-test for conformity to dyars rule	61
Table 4.10: Percentage frequency distributions of larval instars of <i>Sylepta derogata</i>	62

## LIST OF FIGURES

Fig. 4.1:	Number of larvae <i>Sylepta derogata</i> in plants during three planting seasons	27
Fig. 4.2:	Mean weekly count of <i>Sylepta derogata</i> in relation to climatic factors (Early season: March- May 2009)	28
Fig. 4.3:	Mean weekly count of <i>Sylepta derogata</i> in relation to climatic factors (Mid-season: July- August 2009)	29
Fig. 4.4:	Mean weekly count of <i>Sylepta derogata</i> in relation to climatic factors (Late season: November – January 2009)	30
Fig. 4.5	Relationship between no. of infested plants and physical factors at early season planting	37
Fig. 4.6	Relationship between no of infested plants and physical factors at Mid-season planting	38
Fig. 4.7	Relationship between no of infested plants and physical factors at late season planting	39
Fig. 4.8	Relationship between no of larval and physical factors at early season planting	40
Fig. 4.9	Relationship between no of larvae and physical factors at mid-season planting	41
Fig. 4.10	Relationship between no of larvae and physical factors at late season planting	42
Fig. 4.11	Mean no of fruits/block/season	43
Fig. 4.12	Frequency distribution of head capsule width of larval instars of <i>Sylepta derogata</i>	59

## LIST OF PLATES

Plate 2.1:	Okra fruits, <i>Abelmoschus esculentus</i>	4
Plate 2.2:	Adult <i>Sylepta derogata</i>	6
Plate 2.3a:	Rolled leaves of okra by <i>Sylepta derogata</i>	7
Plate 2.3b:	Okra leaf defoliated by <i>Sylepta derogata</i>	7
Plate 3.1:	A cage with potted Okra plants	15
Plate 3.2:	Ventilated wooden cage for oviposition	16
Plate 3.3:	Layout of the experimental plots	18
Plate 3.4:	Insect culture plastic cages	21
Plate 4.1a:	Cocoons of <i>Apanteles species</i>	45
Plate 4.1b:	Parasite: <i>Apanteles species</i>	45
Plate 4.2:	The life cycle of <i>Sylepta derogata</i>	51
Plate 4.3:	Eggs of <i>Sylepta derogata</i>	52
Plate 4.4:	Pre-pupal stage of <i>Sylepta derogata</i>	53
Plate 4.5:	Pupal stage of <i>Sylepta derogata</i>	54
Plate 4.6:	Adult <i>Sylepta derogata</i>	55
Plate 4.7a:	First instar larva of <i>Sylepta derogata</i>	58
Plate 4.7b:	Second instar larva of <i>Sylepta derogata</i>	58
Plate 4.7c:	Third instar larva of <i>Sylepta derogata</i>	58
Plate 4.7d:	Fourth instar larva of <i>Sylepta derogata</i>	58
Plate 4.7e:	Fifth instar larva of <i>Sylepta derogata</i>	58
Plate 4.8:	Mating position of <i>Sylepta derogata</i> in the laboratory.	64

## LIST OF APPENDIX

Appendix: Analysis of variance of separation of head-capsule width of  
*Sylepta derogata*

72

UNIVERSITY OF IBADAN