

**DECLARATION**

I, **Stephen Taulu**, hereby declare that this dissertation represents my own work and that it has not been previously submitted for a degree at this or any other University.

Signature.....

Date.....

**APPROVAL**

This dissertation of **Taulu Stephen** is approved as fulfilling part of the requirements for the award of the degree of Master of Science in Plant Breeding and Seed systems by the University of Zambia.

**Examiner's name**

**Signature**

**Date**

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## ABSTRACT

Post harvest losses caused by the maize weevil (*Sitophilus zeamais*, Motschulsky) in maize aggravate food insecurity among small scale farmers. Maize weevil resistant genotypes are desirable for overcoming storage difficulties and also avoid the use of chemical pesticides hence considered to be more environmental friendly. A study was conducted with an overall objective of establishing the determinants of weevil resistance in maize. The specific objectives of the study were to characterize genotypes for traits related to weevil resistance in maize and also to estimate the genetic basis of the mechanisms of weevil resistance in maize. Field experiments were done at GART using a North Carolina Design II with three replications and also at Nanga research in Mazabuka. Laboratory experiments were conducted at Zambia Agriculture Research Institute (ZARI) Entomology laboratory and University of Zambia, Food Science Department where insect bioassay and the biochemical tests were done respectively. In the insect bioassay grain hardness, grain weight loss, median development period, F<sub>1</sub> progeny emergence and the Dobie index of susceptibility indices were measured. Protein and the Phenolic content were determined under the biochemical tests among genotypes. They were highly significant differences in all the twenty seven genotypes evaluated. Results showed that Parental survival accounted for 78.5 % of the total variation, F<sub>1</sub> emergency (8%) and grain hardness (0.5%), and all these traits would still be important secondary traits to determine the resistance or susceptibility of genotypes in developing the host plant resistance of genotypes. Phenolic content was strongly and positively correlated ( $r = 0.423^{***}$ ) with grain hardness providing a good measure of resistance and it accounted for the 10.9 % of the total variation. Genotype 60N was classified as being resistant since it had the lowest numbers of F<sub>1</sub> progenies (2.3) produced and genotype 78N had a highest number of F<sub>1</sub> progeny emergency of 98. Genotype 1N had a least median development period of 24 days while 60N had a highest median development period of 80.7 days. Weight grain loss for genotype 78N had a highest weight loss of 19.1% compared to genotype 60N which had a 4.3 % loss. Genotypes were significantly different ( $p < 0.05$ ) in the Dobie's index of susceptibility which ranged from 0.4 to 8.3. Out of the twenty seven genotypes, twenty three genotypes were found to be relatively resistant, three were moderately resistant and one genotype was moderately susceptible. The study showed the possibility of breeding maize genotypes with an increased resistance. From the GCA effects it was established that the susceptible lines had a decreasing Phenolic content but increasing Phenolic content resulted in increased resistance. Non-additive gene action played significant roles in determining resistance among the traits measured. This means that population improvement will have to be done through cyclic selection since the traits were showing the heterotic response through inbred line development. Finally, in this study line 151 as a female line and line 10075 as a male line would be considered in further breeding programmes since they performed consistently well. It was therefore concluded that Phenolic content and parental survival can be used as indirect selection criteria for weevil resistance during characterization and also during the routinely SCA effect study for yield in maize, it is possible to test for weevil resistance on experimental hybrids because this trait shows heterotic response.

## **DEDICATION**

I dedicate this dissertation to my wife Prisca for her love and encouragement during my studies and my two sons Luse and Luyando for enduring my long absence from home.

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## TABLE OF CONTENTS

	Page
Title	i
Declaration	ii
Approval	iii
Abstract	iv
Dedication	vi
Acknowledgements	vii
Table of contents	viii
List of Tables	x
List of Figures	xi
List of Appendices	xii
<b>CHAPTER 1: INTRODUCTION</b>	<b>1</b>
<b>CHAPTER 2: LITERATURE REVIEW</b>	<b>3</b>
2.1 Overview of the maize crop	3
2.1.1 Origin of maize	3
2.1.2 Importance of maize crop	3
2.1.3 Composition of maize kernel	4
2.2 Biology of maize weevil	4
2.2.1 Life cycle	5
2.2.2 Host range	6
2.3 Economic importance of weevils	6
2.3.1 Damage of seed by weevils during storage	6
2.3.2 Influence of storage on development of maize weevil	7
2.4 Mechanisms of resistance in maize grain to the maize weevil	7
2.4.1 Kernel hardness	7
2.4.2 Grain size and texture	8
2.4.3 Biochemical compounds	8
2.5 Measuring maize weevil resistance	11
2.5.1 Grain weight loss	11
2.5.2 Adult mortality	11
2.5.3 Nutritional factors	12
2.5.4 Density of infestation	12

2.5.5	Susceptibility index	12
2.5.6	Dobie's susceptibility index	13
2.5.7	Urrelo 'susceptibility index	13
2.6	Inheritance of weevil resistance in maize	14
2.6.1	Gene action	15
2.6.2	Heritability	16
<b>CHAPTER 3: MATERIAL AND METHODS</b>		18
3.1	Materials used	18
3.1.1	Maize and weevils	18
3.2	Methods	18
3.2.1	Phase one: Generation of crosses	18
3.2.2	Phase two: Seed multiplication	19
3.2.3	Phase three: Laboratory analysis	19
3.2.3.1	Weevil bioassay	19
3.2.3.1.1	Grain hardness	21
3.2.3.1.2	Seed damage and weight loss	21
3.2.3.1.3	Dobie's susceptibility index	22
3.2.3.2	Biochemical bioassay	24
3.2.3.2.1	Protein content	24
3.2.3.2.2	Phenolic acid content determination	24
3.3	Statistical analysis	24
<b>CHAPTER 4: RESULTS</b>		27
4.1	General observation	27
4.2	Performance of genotypes for weevil resistance	27
4.2.1	Protein content	27
4.2.2	Phenolic content	27
4.2.3	Parental survival	27
4.2.4	Progeny emergency	27
4.2.5	Median development period	27
4.2.6	Grain weight loss	32
4.2.7	Grain hardness	32

4.2.8	Kernel weight	32
4.2.9	Dobie's index of Susceptibility	32
4.3	Association among variables measured	35
4.4	Stepwise multiple regression	37
4.5	Genetic parameters	38
4.6	Combining Ability	40
<b>CHAPTER 5: DISCUSSION</b>		47
5.1	Factors related to weevil resistance in maize	47
5.2	Inheritance of weevil resistance in maize	51
<b>CHAPTER 6: CONCLUSION AND RECOMMENDATION</b>		55
<b>REFERENCES</b>		56
<b>LIST OF APPENDICES</b>		70

## LIST OF TABLES

	Page
Table 1: Summary of combined analysis of variance for traits among genotypes	29
Table 2: Summary of means of genotypes	30
Table 3: Classification of maize weevil resistance using Dobie index	33
Table 4: Means of traits for parental lines	34
Table 5: Correlation coefficients of <i>S.zeamais</i> infestation on maize genotypes	36
Table 6: Stepwise multiple regression for susceptibility index and other traits	37
Table 7: Summary average degree of dominance for the traits	38
Table 8: Estimated genetic parameters for some traits measured in the maize Genotypes	39
Table 9: Mean square for susceptibility index and other agronomic traits on parental lines	41
Table10: SCA effects of the parental lines	42
Table 11: GCA effects for the parental lines	43

## LIST OF FIGURES

	Page
Figure 1: Seed damage due to weevil attack from some genotypes evaluated	24
Figure 2: Sieving session at Zambia Agriculture Research Institute (ZARI) during the insect bioassay	26

## LIST OF APPENDICES

	Page
Appendix I: Males (insect Resistant Maize Inbred Lines)	62
Appendix II: Female inbred lines	63
Appendix III: Crosses evaluated for weevil resistance in the study	63
Appendix IV: ANOVA table for F1 progeny emergence	64
Appendix V: ANOVA table for moisture content	65
Appendix VI: ANOVA table for median development period	65
Appendix VII: ANOVA table for grain weight loss percentage	66
Appendix VIII: ANOVA table for grain hardness percentages	66
Appendix IX: ANOVA table for kernel weight	67
Appendix X: ANOVA table for mortality percentage	67
Appendix XI: ANOVA table for parental survival	68
Appendix XII: ANOVA table for Phenolic content	68
Appendix XIII: ANOVA table for protein content	69
Appendix XIV: ANOVA table for susceptibility index	69