

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, F₁ 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, F₁ 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 F₁ progenies (2.3) produced and genotype 78N had a highest number of F₁ 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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