

MECHANISMS OF SORGHUM RESISTANCE TO THE SPOTTED

STALKBORER, CHILO PARTELLUS (SWINHOE) LEPIDOPTERA

PYRALIDAE //

by

GREENMAN THEMBA MASINA

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in the University of Nairobi, Department of Zoology.

THIS THESIS HAS BEEN ACCEPTED
THE DEGREE OF..... Ph.D. 198
AND A COPY MAY BE PLACED IN
UNIVERSITY LIBRARY.

DECLARATIONS

This thesis entitled "MECHANISMS OF SORGHUM RESISTANCE TO THE SPOTTED STALKBORER, CHILO PARTELLUS (SWINHOE) LEPIDOPTERA: PYRALIDAE)" is my original work and has not been presented for a degree in any other University.

Signature: Greenman Themba Masina
GREENMAN THEMBA MASINA

This thesis has been submitted for examination with our approval as University Supervisors.

Professor Canute P.M. Khamala

University Supervisor

Signature: [Handwritten Signature]

Professor T.R. Odhiambo

International Centre for Insect

Physiology and Ecology

Signature: [Handwritten Signature]

A B S T R A C T

Stalkborers are some of the most important pests of cereal crops in the tropics and in particular the semi-arid areas. Chilo partellus, the spotted stalkborer, is one of the most notorious pests of sorghum in that it occurs in almost all the areas where sorghum is grown in the semi-arid regions of Asia and Africa. Lately it has been found that this pest is gradually increasing its range and importance.

Of the various sorghum pest control methods available in the semi-arid regions none holds better prospects than the use of resistant varieties. In this study several experiments were conducted to elucidate the mechanisms of resistance of different sorghum cultivars and also to propose the methodology for mechanisms of resistance studies. Accordingly five criteria were used - for explaining these mechanisms. These criteria were : (a) Preference or Non-preference for oviposition of the moth on different sorghum cultivars, (b) Larval establishment of Chilo partellus larvae first instar/ on different sorghum cultivars, (c) Relative leaf damage and stem tunnelling in different sorghum cultivars by C. partellus larvae, (d) Biophysical and preliminary biochemical studies that elucidate the differences in cultivar

susceptibility to C. partellus, and (e) studies on different cultivar tolerances to C. partellus damage.

The oviposition preference studies revealed that sorghum cultivars differed in their suitability as a C. partellus oviposition substrate. Cultivar IS 2205 was the least preferred while IS 18363 was the most preferred. Experiments to identify the factors responsible were inconclusive. Evidence pointed to both biochemical and biophysical factors.

First instar larval establishment studies were also inconclusive even though it was demonstrated that larval establishment was different among the cultivars used. The only definite evidence for poor establishment in some cultivars was biophysical.

Different cultivars were significantly different in their susceptibility to leaf damage. The tendency to form deadhearts was also significantly different. But reasons for these differences were not apparent. Cultivars were not significantly different in their susceptibility to tunnelling even though they had different amounts of fibre, lignin and sucrose.

The single most important factor for the different cultivar susceptibilities was in their different

tolerances to C. partellus attack. Tillering, in particular, was demonstrated to play an important role in compensation for damage. The ability to flower and to produce seed inspite of having a high infestation were also very significant. Susceptible cultivars dried up before they had flowered. Others still, flowered but could not form seed. Using tolerance as a criterion for resistance showed IS 18520 to be the most resistant. Formation of multiple heads was also shown to be an important factor.

Different cultivars had varying effects on the development of C. partellus (antibiosis). However, the antibiotic effect was either insignificant or only just significant statistically.