

Mechanisms of resistance to shoot fly, *Atherigona soccata* in sorghum

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Summary

Sorghum shoot fly, *Atherigona soccata* (Rondani) is an important pest of sorghum in Asia, Africa, and Mediterranean Europe, and host plant resistance is an important component for the management of this pest. The levels of resistance in the cultivated germplasm are low to moderate, and therefore, it is important to identify genotypes with different mechanisms of resistance to pyramid the resistance genes. We studied the antixenosis for oviposition, antibiosis, and tolerance components of resistance in a diverse array of shoot fly-resistant and -susceptible genotypes. The main plants and tillers of SFCR 151, ICSV 705, SFCR 125, and, IS 18551 experienced lower shoot fly deadhearts at 28 days after seedling emergence, produced more number of productive tillers. The insects fed on these genotypes also exhibited longer larval period (10.1–11.0 days compared to 9.3 days on Swarna), lower larval survival and adult emergence (54.7–67.8 and 46.7–52.2% compared to 73.3 and 60.6% on Swarna, respectively), and lower growth and adult emergence indices as compared to the susceptible check, Swarna. Physico-chemical traits such as leaf glossiness, trichome density, and plumule and leaf sheath pigmentation were found to be associated with resistance, and chlorophyll content, leaf surface wetness, seedling vigor, and waxy bloom with susceptibility to shoot fly and explained 88.5% of the total variation in deadhearts. Step-wise regression indicated that 90.4% of the total variation in deadhearts was due to leaf glossiness and trichome density. The direct and indirect effects, correlation coefficients, multiple and step-wise regression analysis suggested that deadhearts, plants with eggs, leaf glossiness, trichomes on the abaxial surface of the leaf, and leaf sheath pigmentation can be used as marker traits to select for resistance to shoot fly, *A. soccata* in sorghum.

Introduction

Sorghum (*Sorghum bicolor* (L.) Moench) is one of the most important cereal crops in the semi-arid tropics. The yield penalties to sorghum are very high starting from seedling stage to harvest, and are allotted maximally to biotic stresses. More than 150 species of insects have been recorded as pests of sorghum, of which sorghum shoot fly, *Atherigona soccata* (Rondani) is an important pest in Asia, Africa, and the Mediterranean Europe. Insect pests cause nearly 32% of the total loss to the actual produce in India (Borad & Mittal, 1983), 20% in Africa and Latin America, 9% in USA (Wiseman & Morrison, 1981). Shoot flies

of the genus *Atherigona* are known to cause 'deadhearts' in a number of tropical grass species (Deeming, 1971; Pont, 1972) and wheat (Pont & Deeming, 2001). Sorghum shoot fly causes an average loss of 50% in India (Jotwani, 1982), but the infestations at times may be over 90% (Rao & Gowda, 1967). The adult fly lays white, elongated, cigar shaped eggs singly on the under-surface of the leaves, parallel to the midrib. After egg hatch, the larvae crawl to the plant whorl and move downward between the folds of the young leaves till they reach the growing point. They cut the growing tip resulting in deadheart formation.

Host plant resistance is one of the most effective means of keeping shoot fly population below economic