Influence of Cytoplasmic Male Sterility on Expression of Different Mechanisms of Resistance in Sorghum to *Atherigona soccata* (Diptera: Muscidae)

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ABSTRACT *Atherigona soccata* (Rondani) (Diptera: Muscidae) is one of the most important pests of sorghum, *Sorghum bicolor* (L.) Moench, in Asia, Africa, and the Mediterranean Europe. Exploitation of cytoplasmic male sterility (CMS) for hybrid production has resulted in considerable narrowing of the genetic base and may increase the vulnerability of this crop to insect pests. Therefore, we studied the expression of different mechanisms of resistance in sorghum to *A. soccata* in CMS (A) and maintainer (B) lines of 12 genotypes under field and greenhouse conditions. The CMS lines of *A. soccata*-resistant genotypes were preferred for oviposition (78.5 versus 71.5% plants with eggs) and suffered greater deadheart incidence (47.6 versus 41.6%) than the corresponding maintainer lines, whereas such differences were not apparent in CMS lines belonging to the susceptible genotypes (92.7 versus 92.3% plants with eggs and 75.6 versus 74.6% deadhearts) under multichoice field conditions. Similar differences also were observed under controlled conditions in the greenhouse. The larval period (9.0 versus 8.8 d) and pupal mortality (18.4 versus 13.4%) were greater on maintainer lines than that on the CMS lines in the resistant group. The male and female pupal weights, fecundity, and antibiosis index were greater on the CMS than on the maintainer lines. The maintainer lines showed better recovery resistance than the CMS lines, but no such differences were observed in tiller deadhearts. The differences in susceptibility to *A. soccata* were greater in the *A. soccata* resistant CMS and maintainer lines than in the CMS and maintainer lines belonging to susceptible genotypes. Conversion of *A. soccata*-resistant genotypes into alternate less susceptible cytoplasmic backgrounds may be undertaken for developing sorghum hybrids with stable resistance to *A. soccata*.

KEY WORDS *Atherigona soccata*, cytoplasmic male sterility, mechanisms of resistance

Sorghum, *Sorghum bicolor* (L.) Moench, is one of the most important cereal crops in the semiarid tropics. It is grown in nearly 86 countries covering an area of ≈43.66 million ha with a grain production of 62.83 million tons and an average productivity of 1.45 tons/ha, of which 30% of the total global area and production is in Asia (FAO 2002). The yield penalties to sorghum are very high, starting from seedling stage to harvest, and are largely the result of biotic stresses. Among the biotic constraints, insect pests are predominant, causing nearly 32% of the total loss to the actual produce in India (Borad and Mittal 1983), 20% in Africa and Latin America, and 9% in United States (Wiseman and Morrison 1981). Insect pests cause losses of >$1 billion in grain and forage yield of sorghum worldwide.

Atherigona soccata (Rondani) (Diptera: Muscidae) is one of the most important pests of sorghum in Asia, Africa, and the Mediterranean Europe. The adult fly lays white, elongated, cigar-shaped eggs singly on the undersurface of the leaves, parallel to the midrib. After hatching the larvae crawl to the plant whorl and move downward between the folds of the young leaves until they reach the growing point. They cut the growing tip and feed on the decaying leaf tissues, resulting in "deadheart" formation. Shoot flies of the genus *Atherigona* are also known to cause deadhearts in several tropical grass species (Deeming 1971, Pont 1972) and wheat (Pont and Deeming 2001). *A. soccata* infestation levels in sorghum can be very high and vary from 0 to 90% (Hiremath and Renukarya 1966, Rao and Gowda 1967), which at times may cause 100% damage under severe outbreak.

Host plant resistance is one of the most effective means of keeping *A. soccata* populations below economic threshold levels, because it does not involve any cost input by the farmers. Plant resistance to *A. soccata* seems to be a complex character and depends on the interplay of number of componential characters, which finally sum up in the expression of resistance to *A. soccata.* Several genotypes with resistance to

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