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Short Communication

Heterosis for shoot fly [*Atherigona soccata* (Rondani)] resistance in sorghum

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In India, more than 75% of the *kharif* sorghum growing area is covered by F_1 sorghum hybrids, and all of them are highly susceptible to shoot fly [*Atherigona soccata* (Rondani)] damage. Shoot fly attack is very severe in late-sown *kharif* and early-sown *rabi* sorghums. The present study was aimed to test whether exploitable heterosis for shoot fly resistance in F_1 hybrids involving CMS (A-lines) and a set of restorers is available.

Fourteen F_7 recombinant inbred lines derived from the cross 296B (shoot fly susceptible) × IS 18551 (resistant) were used as testers to develop 28 F_1 hybrids with two CMS lines (296A and 27A) in a line × tester mating design. All the 14 restorers, 2 CMS lines, their hybrids (28), and the parents of the restorers (296B and IS 18551) were planted in a randomized block design with three replications at the National Research Center for Sorghum (NRCS), Hyderabad during the late *kharif* (first week of August) and early *rabi* (last week of September) cropping seasons of 2004. The test material was evaluated for shoot fly resistance using standard fish-meal screening technique. Each entry was sown in a two-row plot of 4 m length, with an inter row spacing of 0.60 m. No insecticide was applied in the experimental plots. Observations were recorded on number of eggs seedling^{-1} (oviposition) at 21 days after seedling emergence (DAE), and deadhearts (DH %) at 28 DAE. Heterosis (H) was calculated following standard procedures.

In the present study, shoot fly infestation was significantly higher during *kharif* (mean eggs plant^{-1} = 2.49 and DH% = 74.57) as compared to *rabi* (0.80 eggs plant^{-1} and 45.87 DH%) (Table 1). Similar findings have earlier been reported by Dhillon *et al.* [1]. Both the female lines 296A and 27A were highly susceptible during *kharif* and *rabi* seasons. The testers also differed significantly in their reaction to shoot fly. The testers RL120 and RL258 were on a par with the resistant check IS 18551 for eggs plant^{-1} during both the seasons. While the hybrids (27A × RL191, 296A × RL191, 296A × RL120 and 296A × RL193) were on a par with the resistant check IS 18551 for eggs plant^{-1}, none was found to be on a par with the check IS 18551 for deadhearts.

During *kharif*, heterosis for eggs seedling^{-1} varied from –37.37 (296A × RL191) to 61.24 (27A × RL18B) (Table 1) and for deadhearts the range was from -31.96 (296A × RL193) to 33.48 (27A × RL120). Similarly during *rabi*, heterosis ranged from –70.97 (296A × RL6) to 57.89 (296A × RL224) for eggs plant^{-1}, and –47.22 (296A × RL237B) to 41.61 (27A × RL224) for deadhearts. For eggs plant^{-1}, during *kharif*, only one hybrid 296A × RL191 (-37.37*) recorded significant negative heterosis (desirable), while for deadhearts, the hybrids [296A × RL193 (–31.96**), 296A × RL215 (–18.41**) and 27A × RL193 (–15.74*)] showed significant negative heterosis. During *rabi*, 12 hybrids showed significantly negative heterosis for eggs plant^{-1}, and eight hybrids for deadhearts. The hybrids 296A × RL28, 296A × RL191, 296A × RL193, 296A × RL215 showed negative heterosis for both eggs plant^{-1} and deadhearts in both *kharif* and *rabi* seasons. These promising hybrid combinations for shoot fly resistance have to be tested further for confirmation in a large number of trials, and use these tester parents for breeding F_1 hybrids with exploitable heterosis for shoot fly resistance.

A comparison was made between heterosis exhibited by the hybrids involving 296A and those involving 27A as female parents (lines) during *kharif* and *rabi* seasons. It is to be noted that all the male parents (testers) were F_7 derivatives of the cross 296B (shoot fly susceptible) × IS 18551 (resistant). Further, hybrids based on 296A showed higher negative heterosis for both DH% and eggs seedling^{-1} (desirable) than the hybrids based on 27A in both the seasons (Table 1).

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Hybrids with 296A represent allelic combinations from 296B (susceptible) and IS 18551 (resistant) (since the testers were derivatives of 296B × IS 18551). However, in 27A based hybrids, alleles from 27A (susceptible), 296A (susceptible) and IS 18551 (resistant) were being expressed. Thus the hybrids with 27A female parent might contain a higher proportion of undesirable alleles from the susceptible female parents, 27A and 296B while the hybrids with 296A contained alleles from susceptible (296A) and resistant (IS 18551) parents. The higher proportion of undesirable alleles from both the susceptible parents (27A and 296B) might have contributed to the increased incidence of shoot fly attack (positive heterosis) in 27A based hybrids. These results suggests that accumulation of desirable alleles to gradually build the resistance levels in the elite lines [2] can be exploited in developing hybrids with high resistance to shoot fly.

The performances of the testers RL28, RL191, RL193 and RL215 with 296A were desirable for eggs plant^{-1} and deadhearts in both the seasons. Exploitation of heterosis might be possible for resistance to shoot fly.

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References

1. **Dhillon M. K., Sharma H. C., Reddy B. V. S., Ram Singh and Naresh J. S.** 2006. Inheritance of resistance to sorghum shoot fly, Atherigona soccata. Crop Sci., **46**: 1377-1883.

2. **Sharma H. C., Dhillon M. K. and Reddy B. V. S.** 2006. Expression of resistance to *Atherigona soccata* in F_1 hybrids involving shoot fly-resistant and susceptible cytoplasmic male-sterile and restorer lines of sorghum. Plant Breed., **125**: 473-477.