successfully obtaining such a recombination of characters is supported by the correlation coefficient results (Table 2) that show grain yield is significantly positively correlated with plant height, time to 50% flowering, stem diameter, and panicle length and diameter.

The continuing interests of farmers in keeping landraces are obviously due to socio-economic reasons (Carr 1989, Rower 1996). It is therefore important to maintain the morphological features of the local landraces while improving their resistance to *Striga,* tillering ability, and early flowering if possible. In the long run, development of pearl millet varieties resistant to *Striga* could help to substantially reduce the amount of soilborne seed of this parasitic weed and could substantially increase yields by more than use of a tolerant variety that would definitely increase the number of such seeds in the soil each year. The advantage of using resistant sorghum varieties in reducing numbers of *Striga* seeds in the soil and increasing host grain yield in northern Nigeria and Cameroon has already been reported (Weber et al. 1995, Carsky et al. 1996).

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Evaluation of *Striga* Resistance in the Secondary and Tertiary Gene Pools of Pearl Millet

JP Wilson[1*], DE Hess[2,3] and WW Hanna[1] (1. USDA-ARS, Coastal Plain Experiment Station. Tifton, GA 31793-0748, USA; 2. ICR1SAT, BP 320, Bamako, Mali; 3. Agronomy Department, Purdue University, West Lafayette, IN 47907, USA)

*Corresponding author: jwilson@tifton.usda.gov

Introduction

The secondary and tertiary gene pools of pearl millet [*Pennisetum glaucum* (L.) R. Br.] consist of species with various degrees of chromosome homology and interspecific sexual compatibility with *P. glaucum.* Because pearl millet is reproductively isolated from these gene pools, it is likely that genetic variation for resistance to *Striga hermonthica* (Del.) Benth. that has not been apparent in cultivated pearl millet may exist in these species.

The secondary gene pool of pearl millet consists of napiergrass, *Pennisetum purpureum* Schumach. Accessions of this species are maintained at Tifton, Georgia, USA. However, at this location seed rarely develops before frost, and accessions must be propagated vegetatively. Evaluating the secondary gene pool accessions in Georgia would require rooted stem sections - an atypical approach to evaluate *Striga* resistance. To circumvent this problem, pollen can be collected from these accessions and crossed onto cytoplasmic male-sterile selections of pearl millet to produce interspecific F_1 seed to evaluate dominant or additive expression of resistance.

The tertiary gene pool species tend to be resistant to many diseases common to pearl millet (Wilson and Hanna 1992). Although seed set can be relatively low and resulting seeds are often rather small in size, seed is available for direct evaluation of several tertiary gene pool species.

Materials and Methods

Secondary gene pool. Pollen was collected from napier-grass plants grown at Tifton, Georgia, and crossed onto cytoplasmic male-sterile pearl millet in the greenhouse. Resulting hybrids were evaluated in three trials.

At Cinzana, Mali, in 1998, seed was sown in a randomized complete block design with four replications on 10 July. Plots consisted of single rows spaced 1 m apart with 7 hills per entry. *Striga* counts within plots were made 59, 74, and 89 days after sowing. The average maximum number of *Striga* per hill was calculated within plots. At Samanko,

Mali, in 1999, the experiment was conducted in a randomized complete block design with four replications. Each replication consisted of a single-row plot with 6 plants per row. Rows were spaced 1 m apart. Plants were started by germinating seeds in flats in a greenhouse. Seed was sown on 1 July and seedlings transplanted on 13 July. Natural infestation was augmented by artificially infesting in-furrow with *Striga* seed. *Striga* counts were made per plant at 56, 70, 84, 98, and 112 days after transplanting. Average maximum number of *Striga* per plant was determined. At Sadore, Niger, in 1999, seed was sown in pots maintained outdoors in a randomized complete block design with 15 replications. Seed was sown on 9 June and transplanted on 14 June. All pots were artificially infested with *Striga* seed. Numbers of emerged *Striga* per pot were counted at weekly intervals from 25 to 99 days after transplanting.

Tertiary gene pool. Tests were conducted at Samanko in 1998 and at Samanko and Sadore in 1999. Experiments were conducted in randomized complete block designs with four replications. In 1998, seed was sown directly into the field. In 1999, seed was sown in flats in the greenhouse in mid-June and seedlings were transplanted to the field two weeks later. Plots were infested with *Striga* seed in-furrow. *Striga* emergence at Samanko was evaluated at 65, 78, and 92 days after transplanting. In 1999, plant vigor was assessed on a 0 to 5 scale, where 0 = dead and 5 = fully vigorous and healthy.

Species evaluated and number of accessions of each species (in parentheses) included *P. orientate* L.C. Rich. (5), *P. setaceum* (Forsskal) Chiov. (5), *P. nervosum* Trin. (4), *P. pedicillatum* Trin. (4), *P. polystachion* (L.) Schult. (4), *P. schweinfurthii* Pilger (4), *P. squamulatum* Fresen. (4),

Table 1. Average numbers of emerged *Striga* per host plant of F_1 hybrids of pearl millet x napiergrass (N) accessions, Mali and Niger, 1998-1999.

	Average number of emerged *Striga* per host plant			
Hybrid Female x male	Cinzana 1998	Samanko 1999	Sadore 1999	3-test average
Tift $23A_1$x N69	6.7 a	-	-	_
Tift $23A_1$ x N12	5.7 abcd	-	-	-
Tift $23A_1$ x N73	3.4 abcde	-	-	-
Tift $23A_4$E x N 158	2.2 abcde	-	-	-
Tift $23DA_1$x N13	1.0 de	-	-	-
Tift $23A_1$ x N36-1	0.5 e	-	-	-
Tift $23A_4$E x N138	3.3 abcde	0.2 ef	-	-
Tift $23A_1$ x N51	6.5 ab	0.5 de	14.3 abcde	7.1
Tift $23A_4$E x N170	1.4 cde	0.0 f	18.8 a	6.7
Tift $23A_4$E x N166	2.4 abcde	0.3 def	15.2 abc	6.0
Tift $23A_1$ x N9	1.2 de	0.1 ef	16.4 ab	5.9
Tift $23A_4$E x N186	3.1 abcde	0.4 def	12.5 abcdef	5.3
Tift $23A_4$E x N68	0.9 de	0.1 ef	14.6 abcd	5.2
Tift $23A_4$E x N34-1	2.9 abcde	0.4 def	11.6 bcdefg	5.0
Tift $23A_1$x N57	1.4 cde	0.8 cde	12.2 abcdefg	4.8
Tift $23A_4$E x N24-1	2.3 abcde	0.0 f	12.0 abcdefg	4.8
Tift $23A_1$ x N16	3.3 abcde	1.4 c	9.4 bedefg	4.7
Tift $23A_4$E x N185	6.3 abc	0.2 ef	7.2 fg	4.6
Tift $23A_1$ x N74	0.7 e	0.1 ef	12.7 abcdef	4.5
Tift $23A_1$ x N39-2	0.6 e	0.2 ef	11.7abcdefg	4.2
Tift $23A_4$E x N131	0.0 e	0.9 cd	9.1 cdefg	3.3
Tift $23A_4$E x N66	1.0 de	0.4 def	7.0 fg	2.8
Tift $23A_1$ x N14	0.8 de	0.1 ef	7.5 defg	2.8
Tift $23A_1$ x N20	1.6 bcde	0.0 f	6.6 fg	2.7
Tift $23A_4$E x N137	1.3 de	0.3 def	5.1 g	2.2
Controls				
Toronio	2.0 abcde	-	-	-
Boboni	2.3 b	-	-	-
E 36-1 (sorghum)	4.9 a	-	-	-
Sadore local	10.5 bcdefg	-	-	-
lsd (P = 0.05)	4.9	0.7	7.3	-

P. ramosum (Hochst.) Schweinf. (3), *P. villosum* R. Brown ex Fresen (3), *P. alopecuroides* (L.) Sprengel (2), *P. macrourum* Trin. (1), *P. mezianum* Leeke (1), P. *setosum* (Swartz) L.C. Rich. (1), *P. subangustum* (Schumach.) Stapf & C.E. Hubbard (1), *Cenchrus ciliaris* L. (2), and *C. setigres* Vahl (1).

Results

Secondary gene pool. *Striga* infestation varied across locations in this experiment. Levels were lowest at Samanko in 1999 (an unusually wet year) and greatest in the pot trial at Sadore in 1999 (Table 1). Coefficients of variation were characteristically high in each experiment, and ranged from 75% at Sadore to 191% at Samanko. Although numeric differences in *Striga* infestation among entries existed, statistically significant differences were often noted only among the extreme entries. Definitive identification of resistance is not possible from the present data, but parental lines of several hybrids merit further evaluation as sources of resistance. Hybrids involving napiergrass entries 131,66,14,20, and 137 tended to have lower overall *Striga* infestation across the three evaluations.

In addition to *Striga* in the 1999 Samanko and Sadore trials, leaf spots caused by *Pyricularia grisea* (Cke.) Sacc. were evident. No infection by downy mildew (caused by *Sclerospora graminicola* (Sacc.) J. Schrot.) was observed although pearl millet in adjacent trials was infected.

Tertiary gene pool. *Pennisetum* germination was extremely low in 1998 and few plants emerged. No useful data could be obtained from the experiment. In 1999, the tertiary gene pool species tended to be poorly adapted to both the Samanko and Sadore environments. High rainfall at Samanko was a likely cause of poor plant development as was drought at Sadore. Stands of many entries declined from the time of transplanting. At Samanko, many plants were cut off at ground level by insect feeding and roots of many stunted plants appeared to exhibit nematode damage. No downy mildew was observed.

Striga emergence at Samanko was extremely low. Average number of emerged *Striga* per host plant was 0.25 for Boboni, 0.17 for Srriga-susceptible sorghum *[Sorghum bicolor* (L.) Moench] control entry E 36-1, and 0.08 for *P. squamulatum* PS262. No *Striga* was observed on the remaining entries. For comparison, in 2000, an average rainfall year at Samanko, emerged *Striga* on single plants of Boboni and E 36-1 averaged 10.5 and 25.2, respectively. No *Striga* emerged in the Sadore experiment.

Vigor ratings collected in 1999 were analyzed to identify species that might be adapted to sub-Saharan Africa and useful for further studies. Species and their ranges of vigor scores ($1sd_{0.05}$ = 1.0) were: *P. pedicillatum* (4.3-4.9), *P. setosum* (4.1), *P. subangustum* (4.0), *P. macrourum* (4.0), *P. polystachion* (2.1-4.0), *P. nervosum* (0.4-4.4), *P. mezianum* (1.9), *P. schweinfurthii* (1.0-1.9), *P. ramosum* (0.8-1.8), *P. setaceum* (0.9-1.7), *P. squamulatum* (1.3-1.6), *Cenchrus ciliaris* (0.4-1.4), *C. setigres* (1.1), *P. villosum* (0.6-1.1), *P. orientale* (0.3-1.0), and *P. alopecuroides* (0.4-0.6). The *P. pedicellatum* accessions were adapted to both locations and might be further evaluated for their response to *Striga* infestation.

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Anatomical Factors Associated with Resistance to Blast in Finger Millet

AK Jain[1]*, SB Singh[2] and HS Yadava[3] (1. Department of Plant Pathology, JNKVV College of Agriculture, Rewa 486 001, Madhya Pradesh, India; 2. Department of Botany, Government Model Science College, Rewa, Madhya Pradesh, India; 3. Department of Plant Breeding & Genetics, RAK College of Agriculture, Sehore, Madhya Pradesh, India)
*Corresponding author

Introduction

Finger millet *[Eleusine coracana* (L.) Gaertn] is one of the important small millet crops widely cultivated in South Asia and Africa. The crop suffers due to occurrence of blast caused by *Pyricularia grisea* at all stages of crop growth. The disease causes recurring yield losses of around 28%, which can be much higher in epidemic years. Understanding mechanisms of resistance is essential for an effective breeding program. Some attempts (Mohanti et al. 1983) have been made to understand mechanisms of resistance against *Pyricularia* sp. in rice *(Oryza sativa* L.). However, attempts to determine defense mechanisms in finger millet are scanty.