Witchweed Resistance in Sorghum and Millet in the Yemen Arab Republic

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ABSTRACT

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Three cultivars of sorghum (*Sorghum bicolor*) and one pearl millet (*Pennisetum americanum*) from the Yemen Arab Republic were tested for resistance to the root parasite *Striga asiatica*. Red sorghum cultivar Bahry, resistant to *S. hermonthica*, was also resistant to *S. asiatica*. The pearl millet cultivar Faishi, resistant to *S. hermonthica*, was also highly resistant to *S. asiatica*. These sources of resistance to *Striga* spp. have significance in agricultural programs in many countries.

Near the remote Al Ashe Mountain (148 km northwest of Sana'a) in the Yemen Republic is a valley of about 25,000 ha at an elevation of about 1,100 m. Here, a survey was made of more than 40 sorghum (*Sorghum bicolor* (L.) Moench) and pearl millet (*Pennisetum americanum* (L.) Leake) fields. Witchweed (*Striga hermonthica* (Del.) Benth.) was prevalent in many fields, including a large parasite population in a nearby sorghum-millet nursery. The parasitic plant was found in all sorghum fields except those of native red sorghum cultivar Bahry. No parasitic plants were found in fields of pearl millet cultivar Faishi. Samples of sorghum and millet germ plasm were collected and sent to the USDA Methods Development Center, Whiteville, NC, for testing with *S. asiatica* (L.) O. Ktze. (= *S. lutea* Lour.).

Seed of host plants was sown in 20-cm plastic pots filled to within 5 cm of the tops with Lakeland sand. Fertilizer (5-15-30) was applied at the rate of 250 kg/ha. About 2.5 g (0.5 teaspoon) of a mixture of *S. asiatica* seed and sand was applied at this level. An additional 2.5 cm of soil was added and another 2.5 g (0.5 teaspoon) of *S. asiatica* seed and sand mixture was applied on the surface. This procedure gave about 1,000 *S. asiatica* seeds per pot. All host cultivars were replicated three times and randomly placed on benches in the greenhouse (30 ± 2 C). Adequate soil moisture (>50%) and ambient temperatures (30 C day/20 C night) were maintained to promote good growth of the host plants.

Seed of three sorghums and one millet from North Yemen plus two U.S. cultivars of sorghum and maize (*Zea mays* L.) included as checks were tested for resistance to the root parasite *S. asiatica* at Whiteville. Standard procedures for propagation of plants in the greenhouse were used and tests were based on the numbers of emerged stems of the parasite.

A repeat test of the red sorghum Bahry and pearl millet Faishi was initiated in May 1982. Twelve pots were prepared as in the first test with the same treatment. The native U.S. red sorghum and maize (Pioneer Brand 3145) checks comprised six-pot replicates. This experiment resulted in a satisfactory stand of host plants and provided an excellent stand (host support) of *S. asiatica* in all pots.

In the first test with three replicates of sorghum cultivar Bahry, the number of *S. asiatica* stems attached to the host seedlings were 0, 5, and 12, or an average of 5.7 stems (Table 1). In the second test, Bahry sorghum averaged 10.7 parasitic stems in 12 replicates. The other two Yemen sorghums, cultivars Sahul and Harity, were highly susceptible, producing 79.7–96.7 parasitic stems, respectively (Table 1).

Farmers in the Al Ashe Mountain valley have long recognized the resistance of Bahry red sorghum to *S. hermonthica*. The recent increase in prevalence of this plant parasite in their sorghum fields has resulted in a shift to this cultivar in lieu of other higher-yielding but witchweed-susceptible cultivars. The local pearl millet Faishi cultivar has maintained a high level of resistance to *S. hermonthica* and has produced both high yields of grain as well as stalks that are used for animal feed and household fuel.

The Yemen pearl millet Faishi, which is known to be resistant to *S. hermonthica*, had no parasitic stems in the first test (three replicates) and a mean of 0.25 in the second test (12 replicates) when tested with *S. asiatica* (Table 1). This cultivar also has good agronomic qualities.

In East Africa, it is reported that field resistance to *S. asiatica* may not confer resistance to *S. hermonthica* (1). In certain parts of Tanzania, *S. hermonthica* is a major cause of food shortages in certain years and is responsible for the depopulation of agricultural land (4). King and Zummo (2) identified both a sorghum strain and a millet strain of *S. hermonthica* in West Africa.

Striga spp. are one of the most devastating constraints in the culture of sorghum and millet in Africa and Asia. Breeding for resistance to *Striga* spp. is now considered a highly desirable objective, especially for areas with erratic rainfall, low soil fertility, and primitive agriculture (3). The Yemen sorghum cultivar Bahry and pearl millet Faishi could be important adjuncts in the improvement of these crops, particularly in Africa, Arabia, India, and the Middle East.

Table 1. Results of greenhouse studies of sorghum, millet, and maize tested against *Striga asiatica* at Whiteville Methods Development Center in North Carolina

Cultivar	$\bar{x}$ No. *S. asiatica* stems/pot[a]
First test, February 1981	
Yemen pearl millet Faishi	0
Yemen red sorghum Bahry	5.7
Yemen white sorghum Harity	96.7
Yemen orange sorghum Sahul	79.7
Native U.S. red sorghum check	14.0
Maize U.S. Pioneer Brand 3145 check	53.7
Second test, May 1982	
Yemen pearl millet Faishi	0.25
Yemen red sorghum Bahry	10.7
Native U.S. red sorghum check	19.8
Maize U.S. Pioneer Brand 3145 check	29.3

[a] First tests of entries and check were replicated three times, second tests of entries 12 times, and checks six times.

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