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MORPHOLOGY OF *STRIGA FORBESII* AND PRELIMINARY SCREENING FOR RESISTANCE IN SORGHUM

1457

D. Knepper [1] , A. Tunde Obilana [2] , and L. J. Musselman [3]

Striga forbesii Benth, can be a serious pest problem on sorghum in Southern Africa. Its morphology, as found in the region, was described with the mention of a very small population of the species having an unusual floral form with strongly exerted style and stigma. It thus could be possible that there is some outcrossing in this predominantly autogamous species. The species produces up to 24,654 seeds per plant, and its seed production was compared with that of *S. asiatica*. Observation nursery screening showed that between 2.0 and 20.0 percent germplasm accessions, from Zimbabwe, Botswana, Swaziland, Lesotho and Angola, have resistance to *S. forbesii*. In addition, only 6.0 percent from the Alad Nursery and 3.2 percent from the Karper Nursery, which were introduced into the region, showed resistance. Preliminary results from advanced screening trials indicated significant differential reactions to *S. forbesii* attack among sorghum varieties. Using the modified checkerboard design, five varieties, namely SAR 29, SAR 33, SAR 19, SAR 35 and SAR 37, showed good levels of tolerance or resistance to *S. forbesii*. The different reactions of susceptibility and resistance or tolerance were discussed relative to the test varieties.

INTRODUCTION

As the common name, giant maize witchweed, suggests, *S. forbesii* is one of the larger and more robust members of the genus. A general distribution of the species was given by Musselman (1987) and unlike some of the other witchweed species, it is limited to the African mainland and Malagasy Republic. Although it is widely-ranging, it does not seem to be common in any single country. It has also not been found to be an economically important parasitic weed throughout its range (Ramaiah et al., 1983; Musselman and Kepper, 1986) but where it is found on crops as in Southern Africa, it is most often a very significant limiting factor of production (Obilana et.al., 1987). Between 1954 and 1989, countries reporting *S. forbesii* as a pest of crops in Africa numbered eight (Knepper, 1989) out of a total of 18 reporting other witchweeds in the continent.

Careful descriptions of witchweed species throughout their ranges would be helpful in documenting species variation and aid in deciphering relationships within the genus and their reactions with host crops.

The breeding of crops for resistance to *Striga* is considered to be one of the most economical means of control, and has been found to be one major component of integrated control packages in farmers fields. A great deal of effort has been directed towards identifying stable resistance to *Striga* in sorghum, millet and maize (IITA, 1985; Ramaiah, 1987; Vasudeva Rao, 1987). The review work of Ramaiah (1987), describes the breeding of these three crops for resistance to *S. asiatica* and *S. hermonthica*. There has never been any evaluations of sorghum resistance to *S. forbesii*.

The objectives of this paper are to: describe *S. forbesii* with few modifications to characterise local population relative to the descriptions of Musselman and Hepper (1986); and evaluate levels of resistance to the species in sorghum.

MATERIALS AND METHODS

For the description of *S. forbesii*, field collections from Zimbabwe, their actual measurements and counts were used, in addition to previous descriptions of Musselman and Hepper (1986). Seed production was estimated using two methodologies of the Grid System and by weighing as described by Obilana et al. (1987).

Two groups of sorghum materials were used as test entries in the screening and evaluation for resistance to the species. The first group includes 440 sorghum lines from various sources screened in the observation nursery and the second group contains 12 SAR (*S. asiatica* - resistant) sorghum varieties developed at ICRISAT, India, which were evaluated in the advanced screening trial. The 448 sorghums comprise germplasm accessions from

1. *Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529-0266, U.S.A.*
2. *SADCC/ICRISAT Sorghum and Millet Improvement Program, P O Box 776, Bulawayo, Zimbabwe.*
3. *Department of Biological Sciences Old Dominion University, Norfolk, Virginia 23529-0266, U.S.A.*

Since no known susceptible-control was incorporated into this trial, only those test entries which were susceptible to *S. forbesii* could be identified (Table 1). Those test entries which remained witchweed-free, must be re-evaluated in other screening trials before they can be considered "resistant". However, the number of emerged *Striga* plants, ranging from 0-61 in test entry stands of 6-36 plants per plot, were good enough for a preliminary screening nursery.

Despite shortcomings, it is encouraging that there are potentially a dozen different sorghum lines from the 419 test entries that emerged which may possess good level of resistance to *S. forbesii*. Three entries each (2.4%, 6.0%) representing accessions from Zimbabwe germplasm and Alad Nursersy; and one entry each (2%, 10%, 20%, 9.6%, 3.2%) from Botswana, Swaziland, Lesotho, Angola germplasm accessions and Karpers Nurseries; respectively, showed resistance to the species.

Advanced Screening: *Striga forbesii* counts per host row were taken at the same five intervals as th Observation Nursery. Again, the number of emerged witchweed was greatest 130 days after planting. These counts were therefore used to evaluate the response of the test entries. Since witchweed emerges quite close to the host main stem, most emerged witchweed can confidently be assigned to a particular host row.

Each test plot was individually analyzed due to variable infestation levels within and among the replicates (Table 2). In general, the witchweed infestation pressure was greatest in replicate three, with mean infestation level per susceptible plot being 59.9 *Striga* plants.

Table 3 shows a summary of the results of the advanced screening trial. Test entries received a questionable rating if the host plant was considered too small to adequately germinate all *Striga* seed within the plot. Likewise if, the *Striga* infestation pressure was too small, then a reliable resistance rating could not be given.

As shown in Table 3 although SAR 29 and SAR 33 did show good levels of resistance/tolerance to *S. forbesii*, they both had poor seedling establishment. Therefore, further field screening trials must be conducted with these cultivars to verify their reaction. Other test entries which show good levels of tolerance to *S. forbesii* included: SAR 19, SAR 35 and SAR 37.

Framida is a brown-grained sorghum which has been used extensively in the ICRISAT breeding programs due to its high *Striga* tolerance in many parts of the world. Its resistance is thought to be conferred by combination of low root exudate production and mechanical barriers (Ramaiah, 1987). In these trials, Framida was found to have only marginal levels of tolerance to *S. forbesii*. This may be due to the fact that Framida is a traditional cultivar used by the Zimbabwe communal farmers in areas where the *S. forbesii* is found. SAR 2 was also found to have only marginal tolerance to *S. forbesii*.

Cultivars found to be susceptible to *S. forbesii* included: SAR 26, SAR 34, Radar, PMC, and Red Swazi. Radar was once considered to have promising levels of resistance to red-flowered *S. asiatica* in South Africa (Saunders, 1933), but apparentiy lost this through outbreeding (Grobbelaar, 1952). It may also be due to differences in resistance mechanisms and genes controlling inheritance of these mechanisms in *S. asiatica* as compared to *S. forbesii*.

Overall, the SAR lines used in this study have good levels of tolerance to *S. forbesii*, and should prove useful in the breeding programs of the SADCC countries. Research should now focus on improving the agronomic qualities of the most promising SAR cultivars, and making them suitable and appealing for use by the national programs and farmers in the region, in an integrated control package.

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Table 1: Results of the *Striga* observation nursery for 419 sorghum test entries.

Test Entry	Plant Stand	Number Of Emerged *Striga*	Remarks
Angola Collection 6013	21	40	Most Susceptible
Angola Collection 6021	36	61	Most Susceptible
Zimbabwe Collection 5335	20	20	Most Susceptible
Zimbabwe Collection 5382	24	25	Most Susceptible
Botswana Collection 5980	19	23	Most Susceptible
Karpers Nursery 6053	25	41	Most Susceptible
Zimbabwe Collection 5322	16	0	Resistant
Zimbabwe Collection 5342	6	0	Resistant?
Zimbabwe Collection 5371	14	0	Resistant
Botswana Collection 5983	25	0	Resistant
Malawi Collection 5846	16	0	Resistant
Swaziland Collection 5587	23	0	Resistant
Lesotho Collection 5665	23	0	Resistant
Karpers Nursery 6042	19	0	Resistant
Alad Nursery 6096	20	0	Resistant
Alad Nursery 6098	15	0	Resistant
Alad Nursery 6099	22	0	Resistant
Angola Collection 6018	20	0	Resistant

Table 2: *Striga forbesii* infestation levels in Sorghum showing variation among replications.

Description	Rep 1	Rep 2	Rep 3
Number of Susceptible Plots (Excluding Border Plots)	18	18	14
Total Number of *Striga* in Susceptible Plots	558	310	838
Number of Zero Plots [a]	0	2	1
Number of *Striga* Minimum per plot	5	0	0
Number of *Striga* Maximum per plot	90	49	289
Mean Infestation Level	32.7	17.2	59.9

a: ZERO PLOT = a susceptible plot without any emerged *Striga*.