Evaluation of Western Ethiopian Sorghum Landraces for Resistance to Striga hermonthica (Del.) Benth

Minyahil Kebede Earecho*, Esubalew Nebiyu, Habtamu Alemu

Citation: Earecho MK (2024) Evaluation of Western Ethiopian Sorghum Landraces for Resistance to Striga hermonthica (Del.) Benth. Adv Crop Sci Tech 12: 690.

Out of the initial 48 sorghum genotypes tested in pots, a total of 33 sorghum genotypes were selected for further evaluation in a sick-plot speci cally designed to measure their resistance to S. hermonthica. Additionally, another resistant check, Framida variety, was included in this evaluation. e sick-plot trial was conducted at the Assosa Agricultural Research Center [7].

For further validation of the pot and sick-plot trials, seven sorghum genotypes, including resistant check varieties like Berhan and Framida, as well as promising resistant landraces such as ETSL102969, ETSL102970, and ETSL102975, alongside susceptible check varieties like Assosa-1 and ETSL102957 were selected and evaluated under hot-spot farmers' elds in three locations at Assosa, Benishangul Gumuz, Ethiopia [8].

e Striga seeds used in the study were collected over a period of three years, from 2019 to 2021. ese seeds were obtained from sorghum elds that were highly infested with S. hermonthica in various districts of Assosa Zone, speci cally Bambasi, Abramo, and Ura districts. A er collection, the seeds were stored in glass jars, kept in a dark environment at room temperature until they were needed for infesting the pots and sick plots [9].

S d e, a de a d ced e

A trial was established at the Assosa Agricultural Research Center (AsARC), situated in Assosa Zone, Benishangul Gumuz region, Ethiopia. e pot trials were laid out in randomized complete block design having two replications in 2020 and 2021 under the Lath-house condition of AsARC. Sand/peat/compost (1:3:1 v/v) mix soil was used to ll 96 pots. Each pot was infested with 4 mg S. hermonthica seeds at 5 cm depth and covered with a thin layer of the mix soil. A er a 10 day delay to precondition the Striga seed, six sorghum seeds of each genotype were sown in the pot and later thinned to three plants per pot [10].

A total of 33 sorghum genotypes were also evaluated in S. hermonthica sick plot of AsARC in 2022. e trial site was ploughed twice and furrows with 70 cm spacing were prepared. e trial was laid out in RCBD having two replications. e furrows within the trial unit (2 m x 1.40 m) were uniformly infested by S. hermonthica seeds collected during 2021 cropping season, Ethiopia. e infested Striga seeds were covered with a thin layer of soil and preconditioned for 10 days. A er preconditioning, sorghum genotypes were sown within the furrows at a rate of 10 kg ha^{-1}. Apart from Striga, other weeds were t si11k plots [9].

enotypes	Striga plant/plot at 13 WACE	Sorghum plant height (cm)	Days to þowering	Striga per Sorghum	Yield (t ha^{-1})
Berhan	47.30^{c}	117.00^{b}	74.33^{d}		

emergence compared to the resistant check variety Framida in the sick-plot trial. e results are consistent with the ndings from a previous pot trial [16-20].

Result of this study revealed that the resistant sorghum genotypes were early maturing with maturity period of 125 days for the Berhan, 142 days for ETSL102970, and 144 days for ETSL102969. is argued with the nding of Ayana et al. (2019) that reported early maturing sorghum genotypes showed resistance to S. hermonthica. Franke et al. (2006) was also reported that earlier maturing sorghum genotypes had positive response to Striga stress.

Moreover, S. hermonthica resistant sorghum genotypes of this study were shorter plant heights that ranged from 101.96 cm for ETSL102969 to 139.79 cm for Berhan. Similarly, they have lower number of leaves per plant that ranged from 3.45 for ETSL102969 to 5.87 for Berhan [21-23].

As illustrated the genotypes ETSL102970, Berhan, and ETSL102969 have lower ASNPC values compared to other genotypes, indicating a slower or less severe emergence of Striga plants in these resistant sorghum genotypes. On the other hand, genotypes ETSL102957 and ETSL102944 exhibit higher ASNPC values, suggesting a higher incidence and more rapid emergence of Striga plants in these susceptible sorghum genotypes. e resistant checks (Berhan and Framida) also demonstrate low ASNPC values, indicating their resistance to S. hermonthica infestation. ese ndings further support the potential resistance of sorghum genotypes ETSL102970, Berhan, and ETSL102969 against S. hermonthica infestation in Assosa, Benishangul Gumuz region of Ethiopia (Figures 1-3).

Va da a a - fa e ' e d

As illustrated in the results of the validation trial con rm that the resistant check Berhan and sorghum landrace ETSL102969 have the lowest number of emerged S. hermonthica plants per 4m x4m plot. Additionally, sorghum landrace ETSL102970 has a lower number of emerged S. hermonthica plants compared to the second resistant check Framida. e number of Striga per sorghum plant is also low for Berhan, ETSL102969, and ETSL102970 [24].

On the other hand, susceptible checks ETSL102957 and Assosa-1 variety have the highest count of emerged S. hermonthica plants. ese ndings indicate that Berhan ETSL102969, and ETSL102970 exhibit promising resistance against S. hermonthica infestation. Overall, this validation trial con rms that these sorghum landraces possess comparable or good resistance to S. hermonthica when compared to resistant checks like Berhan and Framida [25] (Table 3).

e promising sorghum landraces ETSL102969 and ETSL102970 have been found to have higher yielder yield compared to resistant checks in a validation trial. Additionally, the bold seed size and white seed colour of sorghum landrace ETSL102969 are desirable traits by the local farming communities. ese traits can be advantageous for the breeding program, as they can be combined with the Striga resistance

trait to develop sorghum varieties that have both resistance to Striga infestation and the preferred seed characteristics. By incorporating these additional traits into the breeding program, there is a higher probability of obtaining F-generations that exhibit both white colour and bold sized seeds, along with resistance to S. hermonthica. is

6. Ayana TT, Bantte K, Tadesse T (2019) Evaluation of Ethiopian sorghum [Sorghum bicolor (L.) Moench] landraces: low germination stimulant genotypes for Striga hermonthica resistance under feld condition. Advances in Crop Science and Technology 7:444.

7. Bayable D, Di Marcantonio F (2013) Analysis of incentives and disincentives for sorghum in Ethiopia. Technical Notes Series, MAFAP, Food and Agriculture Organization of the United Nations, Rome, Italy.

8. Ejeta G, Gressel J (2007) Integrating new technologies for Striga control: towards ending the witch-hunt. World Scientifc.

9. Ejeta G, Babiker AGT, Butler L (2002) New approaches to the control of Striga, a training workshop on Striga resistance. Melkassa 14-17.

10. Franke AC, Ellis-Jones J, Tarawali G, Schulz S, Hussaini MA, Kureh I, et al. (2006) Evaluating and scaling-up integrated Striga hermonthica control technologies among farmers in northern Nigeria. Crop protection 25: 868-878.

11. Gethi JG, Smith ME (2004) Genetic responses of single crosses of maize to Striga hermonthica (Del.) Benth. and Striga asiatica (L.) Kuntze. Crop science 44: 2068-2077.

12. Haussmann BI, Hess DE, Welz HG, Geiger HH (2000) Improved methodologies for breeding Striga-resistant sorghums. Field Crops Research 66: 195-211.

13. Haussmann BIG, Hess DE, Reddy BVS, Welz HG, Geiger HH, et al. (2000) Analysis of resistance to Striga hermonthica in diallel crosses of sorghum. Euphytica 116: 33-40.

14. Hearne SJ (2009) Control-the Striga conundrum. Pest Management Science: Formerly Pesticide Science, 65: 603-614.

15. Kountche BA, Al-Babili S, Haussmann BI (2016) Striga: a persistent problem on millets. In Biotic stress resistance in Millets, 173-203.

16. Lendzemo VW, Kuyper TW (2001) Efects of arbuscular mycorrhizal fungi on damage by Striga hermonthica on two contrasting cultivars of sorghum, Sorghum bicolor. Agriculture, ecosystems & environment 87:29-35.

17. Mandumbu R, Mutengwa C, Mabasa S, Mwenje E (2019) Challenges to the exploitation of host plant resistance for Striga management in cereals and legumes by farmers in sub-Saharan Africa: a review. Acta Agriculturae Scandinavica, Section B-Soil & Plant Science 69: 82-88.

18. Matusova R, Rani K, Verstappen FW, Franssen MC, Beale MH, et al. (2005) The strigolactone germination stimulants of the plant-parasitic Striga and Orobanche spp. are derived from the carotenoid pathway. Plant physiology 139: 920-934.

19. Mohamed KI, Musselman LJ (2008) Taxonomy of agronomically important Striga and Orobanche species. Progress on farmer training in parasitic weed management 41: 7-14.

20. Omanya GO, Haussmann BIG, Hess DE, Reddy BVS, Kayentao M, Welz HG, Geiger HH (2004) Utility of indirect and direct selection traits for improving Striga resistance in two sorghum recombinant inbred populations. Field crops research 89: 237-252.

21. [illegible] (2015)