Tapping large genetic variation in water use, grain yield related traits in sorghum minicore collection: New opportunities for enhancing grain yield and drought adaptation Murugesan Tharanya1, Kaliamoorthy Sivasakthi1, Jana Kholova1*, Sunita Choudhary1, Tsuyoshi Tokunaga2, Keerthi Vysyaraju1,3, Sudheer Kumar Peri1, Ravi Prakash Saini4, Vincent Vadez 1,5, Santosh P Deshpande1, Rajeev Gupta1, Anthony Whitbread1 1International Crops Research Institute for the Semi–Arid Tropics (ICRISAT), Crop Physiology Laboratory, Patancheru 502324, Telangana, India. 2EARTHNOTE Co. Ltd., Nago, Okinawa 905-1152, Japan. 2 Centurion University of Technology and Management (CUTM), Odisha, India. 4ICAR- Indian Grassland and Fodder Research Institute, Gwalior Road, Jhansi - 284 003, Uttar Pradesh, India. 5Institut de Recherche pour le Developement (IRD) – Université de Montpellier – UMR DIADE, 911 Avenue Agropolis, BP 64501, 34394 Montpellier cedex 5 France. * To whom correspondence should be addressed. E mail: J.kholova@cgiar.org List of authors and Email ID Murugesan Tharanya : m.tharanya@gmail.com Kaliamoorthy Sivasakthi : sakthibiotechbdu@gmail.com Jana Kholova : J.Kholova@cgiar.org Sunita Choudhary : S.Choudhary@cgiar.org Tsuyoshi Tokunaga : Keerthi Vysyaraju : Keerthivysyaraju21@gmail.com Sudheer Kumar Peri: Sudheerkumarperi@gmail.com Ravi Prakash Saini : Raviprakashsaini2@gmail.com Vincent Vadez : v.vadez@cgiar.org Santosh P Deshpande : S.Deshpande@cgair.org Rajeev Gupta: G.Rajeev@cgiar.org Anthony Whitbread : A.Whitbred@cgiar.org

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Text

Abstract

Sorghum (Sorghum bicolor (L.) Moench) is the fifth most important cereal crop globally and serves the most food-insecure regions in the semi-arid tropics. Although sorghum is considered resilient in semi-arid tropics, they do suffer significant terminal drought due to cessation of rain towards the end of the rainy season for which breeding efforts are needed. Addressing the genetic variation is foremost pre-requisite to exploit in any breeding programs. Therefore, present study was taken to assess the genetic variation in the sorghum minicore collection for traits related to plant water use and was hypothesized to be closely related to crop adaptation under water limited environments i.e., transpiration efficiency (TE; amount of biomass produced by per unit of water utilized), water use efficiency (WUE; amount of grains produced by per unit of water utilized) as well as agronomically important traits. These traits were assessed in 242 genotypes of sorghum minicore collection (Bicolor, Durra, Caudatum, Guinea, Kafir) along with 20 elite cultivars under well-watered (WW) and water stressed (WS) conditions. Grain yield was not related to flowering and was found to be tightly correlated to water-use (TE and post flowering water use) and yield related traits under WW conditions. Significant variations was found for all traits measured. Most importantly, some of the minicore entries showed higher TE and water extraction capacity under WS than the existing elite cultivars. In addition, mapping of minicore entries for geo-locations showed that most of the high TE lines preferentially originate from the semi-arid regions of India and Africa. Among the different races, Durra race had high TE (WW and WS) and GY (WW). In summary, high genetic variation for TE and GY was found that offer substantial breeding opportunities with Durra race being a critical source for key drought adaptive traits in sorghum diversity panel.