Short Communication

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Identification and characterization of a novel sorghum genotype with unique floral morphology- Six stamens and two gynoecia

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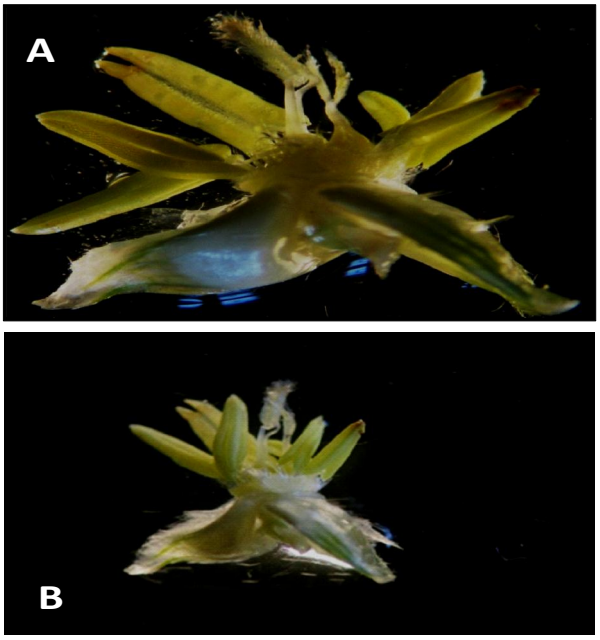
Abstract
A novel sorghum genotype (identity SGS 389) was recovered from the germplasm collection characterized by six stamens and two gynoecia which is a trait reported for the first time. Floral analysis exposed that all the stamen and gynoecia were fertile as they produced two seeds in each spikelet instead of one, in contrast to the normal sorghum generating one seed per spikelet. The novel genotype was characterized for agromorphological traits as per the DUS guidelines. The novel genotype can provide an insight into understanding the genetic control and regulatory mechanism of floral structure development in sorghum in particular as well as grasses in general.

Keywords: Gynoecia, Reproductive Biology, Sorghum, Stamens

The inflorescence of cereals such as sorghum, wheat and rice comprised of a unique reproductive unit called spikelet which originate on the main inflorescence rachis or on branches formed on the main rachis (Peng, 2003). Particularly the sorghum inflorescence consisted of two spikelets of which one is always sessile and the other is pedicellated. The sessile spikelet is bisexual and pedicellated is generally male or sterile. However, floral abnormalities like spikelet shoots, scaly proliferation, multiple-seeded spikelets, polyembryony, and fertile pedicellated spikelets have been observed in sorghum which are generally governed by environmental factors and are not hereditary (Stephens, 1936). An individual sessile spikelet of sorghum normally contains one gynoecium and three stamens. We report here a novel sorghum genotype (identity SGS 389) characterized by six stamens and two gynoecia. This communication describes characteristic features of the genotype and its possible utilization in understanding the genetic mechanism of floral morphology in sorghum as well as in grasses.

During the germplasm evaluation study performed at Central Research Farm of Indian Grassland and Fodder Research Institute (IGFRI) in the rainy season of 2012, a novel genotype bearing six stamens and two gynoecia was observed (Fig. 1). The genotype was planted in three rows of 4 m length along with other genotypes under evaluation with row spacing of 50 cm and plant to plant spacing of 15 cm. Critical examination of all the plants in three rows revealed that this unique trait had 100% expressivity and 100% penetrance. The panicles of 60 plants were enveloped from heading to completion of flowering stage to ensure complete self-pollination. During the rainy season of 2013, self seeds of each plant were planted in paired rows of 4 m length. No within line and between line variation was observed for the unique trait among the self progenies. Rigorous examination of sessile spikelets in individual plants of each progeny revealed that the novel trait is stably inherited, suggesting its genic control. Interestingly all the spikelets having six stamens and two gynoecia also produced two seeds in contrast to the normal sorghum generating one seed per spikelet (Fig. 1). Thus production of two seeds per spikelet indicates that all the six stamens and two gynoecia were fertile.



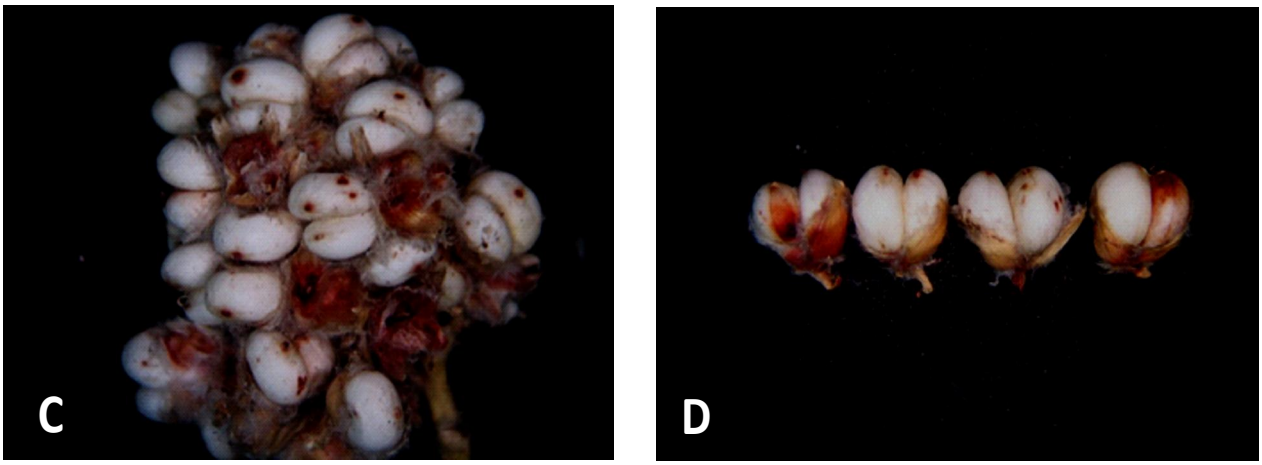


Fig 1. Sessile spikelet of the novel genotype (SGS 389): A and B: Single flower having six stamens and two gynoecia; C. Bunch of twin seeded spikelets; D. Single spikelet bearing twin seeds.

Table 1. Agromorphological characterization of the novel genotype (SGS 389)

Trait	Mean value	Category
Qualitative traits		
Anthocyanin colouration of coleoptiles	-	Yellow green
Anthocyanin colouration of leaf sheath	-	Yellow green
Mid rib colour	-	White
Yellow colouration of flag leaf	-	Absent
Anthocyanin colouration of stigma	-	Absent
Colour of dry anther	-	Yellow orange
Glume colour	-	Yellow white
Density of panicle at maturity	-	Compact
Panicle shape	-	Symmetric
Caryopsis colour after threshing	-	White
Grain shape in dorsal view	-	Circular
Grain shape in profile view	-	Circular
Grain lustre	-	Non lustrous
Quantitative traits		
Time of panicle emergence	75 days	Medium
Height of the plant up to the base of flag leaf	234.3 cm	Tall
Anther length	3 mm	Short
Panicle length	15.4 cm	Short
Length of panicle branches	4.3 cm	Short
Panicle length	15.4 cm	Short
Length of panicle branches	4.3 cm	Short
Length of neck of panicle	3.5 cm	Very short
Weight of 1000 grains	18.3 gm	Low

The novel genotype was characterized for general agromorphological traits following the DUS guidelines and it falls in medium category (75 days) for time of panicle emergence, tall (234.3 cm) height of plant up to the base of flag leaf and white category of caryopsis colour after threshing (Table 1). The sessile spikelet was characterized by absence of anthocyanin of stigmas, short anthers (3 mm), yellowish orange colouration of dry anothers and yellowish white colouration of glumes (Table 1).

The differentiation of androecium and gynoecium in flowering plants occurs very early in floral development and is mostly complete and irreversible. However deviations have been reported in *Arabidopsis* (Goto and Meyerowitz, 1994) and rice (Zhang *et al*., 2007). In sorghum reports on development of more than one seed / spikelet are available in some

American genotypes but these instances are very rare, moreover the spikelet contained one fertile flower in each cases (Karper, 1931). However, the novel genotype reported in the present study is unique as it produces twin seeds but the spikelet bears six stamens and two gynoecia. The novel genotype will be extremely useful in studying the molecular mechanism governing the deviations from normal reproductive biology of grasses and specifically the role of homeobox genes governing or restricting the number of floral parts. To the best of our knowledge, it is the first report on a sorghum genotype having six stamens and two gynoecia.

References

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