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DUS CHARACTERIZATION IN SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH)

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SUMMARY

The experimental material for the DUS characterization was consisted of 150 sorghum germplasm lines. Based on the variation observed in this character, seedling anthocynin coloration it was distinguished into two categories namely, yellow green (65 genotypes) and grayed purple (85 genotypes). At 5th leaf stage genotypes were characterized on the basis of two characters, leaf sheath anthocyanin colouration and leaf midrib colour. On the basis of leaf sheath anthocyanin colouration, the genotypes were categorized into two categories: yellow green (65 genotypes) and grayed purple (85 genotypes). On the basis of leaf midrib colour, the genotypes were categorized into two groups: white (49 genotypes) and yellow green (101 genotypes).On the basis of panicle emergence (50% of plants with 50% flowering), the genotypes were grouped into five categories *viz.,* very early (13 genotypes), early (16 genotypes), medium (56 genotypes), late (47 genotypes) and very late (18 genotypes) for time of panicle emergence. On the basis of lemma arista formation, the genotypes are broadly into two categories: lemma arista present (63 genotypes) and absent (87 genotypes). Based on flower with pedicel length of flower, the genotypes were divided into five categories *viz.,* very short (4 genotypes), short (12 genotypes), medium (53 genotypes), long (71 genotypes) and very long (10 genotypes. Based on anther length, the genotypes were divided into two categories *viz.,* short (125 genotypes) and medium (25 genotypes). On the basis of glume colour, the genotypes were categorized into six groups *viz.,* green white (22 genotypes), yellow white (40 genotypes), grayed yellow (18 genotypes), grayed orange (44 genotypes), grayed red (20 genotypes), grayed purple (6 genotypes). On the basis of panicle length of branches, the genotypes were categorized into two groups *viz.,* short (141 genotypes) and medium (9 genotypes). On the basis of panicle density at maturity, the genotypes were divided into four categories *viz.,* very loose (17 genotypes), semi loose (29 genotypes), semi compact (62 genotypes) and compact (42 genotypes). On the basis of neck of panicle visible above sheath, the genotypes were grouped into five groups namely, very short (54 genotypes), short (40 genotypes), medium (29 genotypes), long (18 genotypes) and very long (9 genotypes).

Key words : Sorghum, *Sorghum bicolor*, DUS chracterization, morphological traits

Shortage of fodder is one of the main reasons for low milk production and lower meat in the country. Various forages like sorghum, millets, cowpea and guar are grown to fulfill the dietary needs of the animals in summer season. Among these fodders, sorghum is of prime importance (Rana *et al.*, 2014). Sorghum (*Sorghum bicolor* (L.) Moench) ranks the fifth most produced food crop in the world and is a dietary staple for over 500 million people in over 30 countries. Sorghum is indigenous to Africa and most of prevalent varieties originated on that continent. Sorghum was also grown in India before recorded history and in Assyria as early as 700 BC. Sorghum belong to family Poaceae and tribe Andropogoneae (Harlan and de Wet, 1972). Sorghum fodder is suitable for silage and hay making. Forage Sorghum plant grows 6 to 12 ft tall and produces more dry matter tonnage than grain Sorghum. At present, ICRISAT is a major repository for world sorghum germplasm with a total of 36,774 accessions from 91 countries. The collection is estimated to represent about 80% of the variability present in sorghum (Eberhart *et al.,* 1997). Landraces constitute 85.3%, breeding material 13.2%, wild species accessions 1.2% and named cultivars 0.3% of the total collection. The germplasm maintained at ICRISAT consists of five basic races: bicolor, guinea,

caudatum, kafir and durra and their 10 hybrid races. However, the collection is predominantly represented by three races: durra (23.5%), caudatum (20.6%) and guinea (14.8%). Of the 10 hybrid races, only three, durra-caudatum (11.5%), guinea-caudatum (9.2%) and durra-bicolor (7.1%) are common. India, Uganda and Zimbabwe have all the five basic and ten hybrid races (Gopal Reddy et al. 2002). Guinea-caudatums, durra and their hybrid races are well-represented in Ethiopia, and caudatum and its hybrid races in Sudan.

Plant breeders are engaged in developing the new varieties of crops for betterment of fodder yield and disease resistance so that the demand for fodder can be fulfilled and development of varieties is possible if large amount of genetic variability is available. DUS Testing is one of the important criteria to test for distinctness, uniformity and stability of variety/ genotypes. It provides a detailed description of accessions (Shahaji *et al*., 2020). DUS testing of cultivars is one of the requirements for granting Plant Breeders Rights (PBR) and it is conducted according to national guidelines prepared on the basis of UPOV guidelines. Information is, thus, generated on the basis of internationally accepted and followed norms, thereby providing a basis for appropriate comparison of materials identified under the National Agricultural Research System (NARS) alongside materials from other sources. As DUS testing data is essential for grant of protection to new plant varieties to compare the candidate varieties with varieties of common knowledge at the time of filling application (Yadav *et al*, 2013). Therefore, keeping the above facts in view, morphological characterization of sorghum germplasm for DUS traits was carried out.

MATERIALS AND METHODS

Present investigation was carried out to examine the different morphological characters for distinctness, uniformity and stability of germplasm lines of sorghum (*Sorghum bicolor* (L.) Moench). All the150 sorghum germplasm lines were grown at Breeding Research Area, Forage Section, Department of Genetics and Plant Breeding CCSHAU Hisar in a randomized block design with three replications. Observations on morphological characters were recorded on five plants in metric scale for each cultivar, while the qualitative characters were recorded in different classes on population basis. Each character was characterized with the help of descriptors provided in the National Test Guidelines for DUS testing of sorghum. Observations were recorded on following morphological characters viz. seedling anthocyanin colouration of coleoptiles, leaf sheath anthocyanin colouration, leaf mid rib colour (5th fully developed leaf), days to panicle emergence (50% of the plants with 50% of anthesis), height of the plant up to the base of flag leaf, flag leaf yellow colouration of mid rib, lemma arista formation, stigma anthocyanin colouration, stigma yellow colouration, stigma length, flower with pedicel: length of flower, anther length, anther colour of dry anther, glume colour , panicle length of branches , panicle density at maturity, panicle shape, neck of panicle visible above sheath, and glume length.

RESULTS AND DISCUSSION

The variability in the population is largely due to genetic cause with least environment effect, the possibility of selecting superior genotypes is a prerequisite for obtaining higher yield, which is the ultimate expression of various yield contributing characters. But the maximum genetic variability which was present in genotypes has already exhausted and further selection in these genotypes has narrowed genetic variability. The basic material utilized in finding genetic variability is germplasm. Collection and characterization of existing landraces germplasm is important for identifying potential germplasm for varietal improvement programme and to avoid duplication in the germplasm collection. As germplasm has broad genetic base so it can be used as a diverse breeding material. Besides meeting the requirement of registration of the new variety, the botanical description is also used for awarding Plant Variety Protection, for which uniqueness is an essential requirement. With respect to India, (Sharma, 1991) has indicated that no system of variety registration exists in India apart from the rather vague variety release proposals provided by the breeders and there is a need for establishing a DUS testing system in India. The government has enacted the legislation on Protection of Plant Varieties and Farmers Rights (PVP and FR) Act in 2001 and the regulations for implementing the act were formulated in 2003. The act provides protection of new varieties including extant, notified and farmer's varieties. Novelty, Distinctness, Uniformity and Stability are the essential criteria. The DUS testing principles are used for the protection of variety and award of Plant Breeder's Rights (PBR), a system of intellectual property protection which is available to breeders of

all types of crops. Government of India under the obligation of the TRIPS agreement has passed the Protection of Plant Varieties and Farmers' Rights Act, 2001 (PPV&FR Act) to encourage public/private investment in research and development of new plant varieties by giving protection to the plant varieties against unauthorized multiplication of seeds or propagating materials for a specified period. The selection strategy employed in the All India Coordinated Crop Improvement Programmes, the system of multi-location testing of new varieties concentrates on selection for yield with emphasis on selection of one important adaptive trait i.e. flowering time, towards which there is strong stabilizing selection. The Protection of Plant Varieties and Farmers' Right Authority was established in the year 2005. Varietal descriptions provided by the concerned breeders are generally inadequate to characterize a variety or varietal mixture. Therefore, there is a great need to characterize genotypes to identify varietal purity, Protection of Plant Variety and Farmers' Right. In the present investigation, 150 sorghum germplasm lines were grouped into different classes on the basis of observation recorded as per the guidelines of Protection of Plant Varieties & Farmers Right Authority (PPVFRA, 2007) for morphological characters in the field at different stages of plant growth.

Seedling and 5th leaf stage Morphological characteristics

Sorghum seedling anthocyanin colouration of coleoptiles was examined at seedling stage for their characterization. Based on the variation observed in this character (Table 1), it was distinguished into two categories namely, yellow green (64 genotypes) and grayed purple (86 genotypes). Similar results were reported for seedling anthocyanin colouration of coleoptiles by Raghuvanshi *et al.* (2014). They classified genotypes on the basis of seedling anthocyanin colouration at seedling stage.

At 5th leaf stage genotypes were characterized on the basis of two characters, leaf sheath anthocyanin colouration and leaf midrib colour of 5th fully developed leaf. Based on the variation observed in this character, it was possible to distinguish all genotypes broadly into two categories: yellow green (65 genotypes) and grayed purple (85 genotypes). On the basis of leaf midrib colour the genotypes were categorized into two groups: white (49 genotypes) and yellow green (101 genotypes).Similar results were reported Raghuvanshi *et al.* (2014) classified genotypes on the basis of leaf sheath anthocyanin colouration at 5th leave stage. Further, Sangwan *et al.* (2005) and Elangovan *et al.* (2007) were classified 12 and 157 sorghum genotypes on the basis of midrib colour (white and green), respectively. Similarly, Reddy *et al.* (2008) reported inheritance of midrib colour (brown and white) in eight segregating populations. Habindavyi (2009) classified genotypes based on leaf midrib colour.

Panicle emergence stage

At panicle emergence stage genotypes were characterized on the basis of panicle emergence (50% of plants with 50% flowering), natural height of plant up to the base of flag leaf and flag leaf yellow colouration of midrib at panicle emergence stage. On the basis of panicle emergence (50% of plants with 50% flowering) were grouped into five categories *viz.,* very early (13 genotypes), early (16 genotypes), medium (56 genotypes), late (47 genotypes) and very late (18 genotypes) for time of panicle emergence. whereas, genotypes were divided into three groups i.e. very short (31 genotypes), short (107 genotypes) and medium (12 genotypes) on the basis of plant height up to the base of flag leaf. Whereas, genotypes were categorized into two groups; yellow (40 genotypes) and without yellow (110 genotypes) on the basis of flag leaf yellow colouration in midrib of flag leaf. Similar results were reported by Reddy *et al*. (2008) for pattern of midrib colour (recorded at, fifth leaf stage, sixth leaf stage and at the time of panicle emergence). Similarly, Reddy *et al.* (2009) studied 29 sorghum genotypes on the basis of time of panicle emergence. Further, results were reported by Kannababu *et al.* (2013) for days to panicle emergence, plant height up to base of flag leaf and total plant height. Similarly, Raghuvanshi *et al.* (2014) reported for flag leaf yellow coloration of sorghum genotypes.

Flowering stage

At flowering stage genotypes were characterized into different groups based on lemma arista formation, stigma anthocyanin colouration, stigma yellow colouration, anther length, stigma length, colour of dry anther and flower with pedicel length of flower. Based on the lemma arista formation observed on this character, it was possible to distinguish all genotypes broadly into two categories: lemma arista present (63 genotypes) and absent (87

TABLE 1
DUS characterization of sorghum genotypes on the basis of morphological characters

Seedling anthocyanin colouration of coleoptiles	
Present (85)	IC-485180, IC-484860, IC-546929, IC-121559, IC-484320, IC-484962, IC-484968, IC-485024, IC-240845, IC-240846, IC-240856, IC-240860, IC-240872, IC-240876, IC-240877, IC-240879, IC-240883, IC-240884, IC-484974, IC-484997, IC-485009, IC-485011, IC-484515, IC-484583, IC-484628, IC-484714, IC-485177, IC-484591, IC-484729, IC-484767, IC-484826, IC-484351, IC-484445, IC-484489, IC-484491, IC-298598, IC-298605, IC-309906, IC-309914, IC-309944, IC-353607, IC-585143, IC-585174, IC-585176, IC-585177, IC-585180, IC-585184, IC-585185, IC-585189, IC-585190, IC-585191, IC-585192, IC-585193, IC-585194, IC-585195, IC-585196, IC-585197, IC-585198, IC-585200, IC-585201, IC-585202, IC-585203, IC-585204, IC-585205, IC-585209, IC-585218, IC-585219, IC-585233, IC-585234, IC-585239, IC-585240, IC-296496, IC-395722, IC-395816, IC-436523, IC-436527, IC-436572, IC-436577, IC-527019, IC-397246, IC-436682, IC-436791, IC-436796, IC-436867, IC-436916
Absent (65)	EC-486333, IC-484895, IC-485002, IC-240831, IC-240832, IC-240833, IC-40835, IC-240837, IC-240838, IC-240839, IC-240840, IC-240841, IC-240842, IC-240843, IC-240848, IC-240849, IC-240850, IC-240851, IC-240852, IC-240853, IC-240855,IC-240859, IC-240861, IC-240862, IC-240864, IC-240865, IC-240866, IC-240871, IC-240880, IC-240881, IC-485023, IC-485028, IC-485030, IC-485039, IC-484819,IC-484869, IC-484870, IC-484911, IC-484989, IC-485003, IC-485244, IC-484696,IC-485145, IC-484750, IC-484855, IC-484418, IC-484430, IC-484444, IC-484510, IC-484637, IC-484658, IC-485143, IC-485188, IC-485202, IC-485233, EC-64430, IC-298601, IC-309905, IC-309907, IC-585225, IC-413297, IC-413299, IC-527022,IC-436752, IC-436857
Leaf sheathanthocyanin colouration	
Present (85)	IC-485180, IC-484860, IC-546929, IC-121559, IC-484320, IC-484962, IC-484968,IC-485024,IC-240845, IC-240846, IC-240856, IC-240860, IC-240872, IC-240876, IC-240877, IC-240879, IC-240883, IC-240884, IC-484974, IC-484997, IC-485009, IC-485011, IC-484515, IC-484583, IC-484628, IC-484714, IC-485177, IC-484591, IC-484729, IC-484767, IC-484826, IC-484351, IC-484445, IC-484489, IC-484491, IC-298598, IC-298605, IC-309906, IC-309914, IC-309944, IC-353607, IC-585143,IC-585174, IC-585176, IC-585177, IC-585180, IC-585184, IC-585185, IC-585189, IC-585190, IC-585191, IC-585192, IC-585193, IC-585194, IC-585195, IC-585196, IC-585197, IC-585198, IC-585200, IC-585201, IC-585202, IC-585203, IC-585204, IC-585205, IC-585209, IC-585218, IC-585219, IC-585233, IC-585234, IC-585239, IC-585240, IC-296496, IC-395722, IC-395816, IC-436523, IC-436527, IC-436572, IC-436577, IC-527019, IC-397246, IC-436682, IC-436791, IC-436796, IC-436867, IC-436916
Absent (65)	EC-486333, IC-484895, IC-485002, IC-240831, IC-240832, IC-240833, IC-40835,IC-240837, IC-240838, IC-240839, IC-240840, IC-240841, IC-240842, IC-240843, IC-240848, IC-240849, IC-240850, IC-240851, IC-240852, IC-240853, IC-240855, IC-240859, IC-240861, IC-240862, IC-240864, IC-240865, IC-240866, IC-240871, IC-240880, IC-240881, IC-485023, IC-485028, IC-485030, IC-485039, IC-484819, IC-484869, IC-484870, IC-484911, IC-484989, IC-485003, IC-485244, IC-484696, IC-485145, IC-484750, IC-484855, IC-484418, IC-484430, IC-484444, IC-484510, IC-484637, IC-484658, IC-485143, IC-485188, IC-485202, IC-485233, EC-64430, IC-298601, IC-309905, IC-309907, IC-585225, IC-413297, IC-413299, IC-527022, IC-436752, IC-436857
Leaf Midrib Colour	
White (49)	IC-484962, IC-240849, IC-240850, IC-240851, IC-240860, IC-485039, IC-485244, IC-484515, IC-484583, IC-484628, IC-485177, IC-484591, IC-484826, IC-484444, IC-484445, IC-484489, IC-484491, IC-484510, IC-484658, IC-485143, IC-485188, IC-485202, IC-298605, IC-309905, IC-309906, IC-309907,IC-309914,IC-309944, IC-585174, IC-585177, IC-585185, IC-585189, IC-585191, IC-585196, IC-585200, IC-585201, IC-585204, IC-585209, IC-585218, IC-585219, IC- 585233, IC-585234, IC-585239, IC-585240,IC-413299, IC-436523, IC-436577, IC-527019, IC-436752
Yellow green (101)	IC-585143, IC-485180, EC-486333, IC-484860, IC-546929, IC-121559, IC-484320, IC-484895, IC-484968, IC-485002, IC-485024, IC-240831, IC-240832, IC-240833, IC-240835, IC-240837, IC-240838, IC-240839, IC-240840, IC-240841, IC-240842, IC-240843, IC-240845, IC-240846, IC-240848, IC-240852, IC-240853, IC-240855, IC-240856, IC-240859, IC-240861, IC-240862, IC-240864, IC-240865, IC-240866, IC-240871, IC-240872, IC-240876, IC-240877, IC-240879, IC-240880, IC-240881,IC-240883, IC-240884, IC-484974, IC-485023, IC-485028, IC-485030, IC-484819, IC-484869, IC-484870, IC-484911, IC-484989, IC-484997, IC-485003, IC-485009, IC-485011, IC-484696, IC-484714, IC-485145, IC-484729, IC-484750, IC-484767, IC-484855, IC-484351, IC-484418, IC-484430, IC-484637, IC-485233, EC-464430, IC-298598, IC-298601, IC-353607, IC-585176, IC-585180, IC-585184, IC-585190, IC-585192, IC-585193, IC-585194, IC-585195, IC-585197, IC-585198, IC-585202, IC-585203, IC-585205, IC-585225, IC-296496, IC-395722, IC-395816, IC-413297, IC-436527, IC-436572, IC-527022, IC-397246, IC-436682, IC-436791, IC-436796, IC-436857, IC-436867, IC-436916
Days to panicle emergence (50% of the plants with 50% of anthesis)	
Very early (<56 days) (13)	IC-298598, IC-309906, IC-309914, IC-485233, IC-309944, IC-585176, IC-585177, IC-484729, IC-309907, IC-353607, IC-585174, IC-585194, IC-413297
Early(56-65 days) (16)	IC-240852, IC-309905, IC-585184, IC-585185, IC-484320, IC-484968, IC-484962, IC-585234, IC-298605, IC-484819, IC-121559, IC-484895, IC-240848, IC-485177, IC-546929, IC-240860
Medium (66-75 days) (56)	IC-240861, IC-240876, IC-240845, IC-485023, IC-240871, IC-240872, IC-240877, IC-484870, IC-585192, IC-585201, IC-240831, IC-240838, IC-240849, IC-485145, IC-436796, IC-484860, IC-240837, IC-240840, IC-240841, IC-240866, IC-585180, IC-585203, IC-585209, IC-395722, IC-395816, IC-485003, IC-484750, IC-436682, IC-484591, IC-585193, IC-585195, IC-585240, IC-240853, IC-484515, IC-585189, IC-585190, IC-436791, IC-485002, IC-485024, IC-240832, IC-240833, IC-240835, IC-240839, IC-240842, IC-240851, IC-240862, IC-240864, IC-484989, EC-464430, IC-585143, IC-585191, IC-585197, EC-486333, IC-240843, IC-240850, IC-585198
Late (76-85 days) (47)	IC-485180, IC-240846, IC-484911, IC-585196, IC-585202, IC-585205, IC-585239, IC-485030, IC-484489, IC-296496, IC-485011, IC-484767, IC-527022, IC-484997, IC-484628, IC-484855, IC-484351, IC-585200, IC-240856, IC-240883, IC-240884, IC-484974, IC-485028, IC-585218, IC-436523, IC-484583, IC-484826, IC-484418, IC-484444, IC-585204, IC-436527, IC-436572, IC-485039, IC-484714, IC-484445, IC-413299, IC-240855, IC-240865, IC-240879, IC-240881, IC-485009, IC-485244, IC-485188, IC-298601, IC-436577, IC-397246, IC-436752
Very late (>85 days) (18)	IC-240859, IC-484869, IC-484510, IC-484637, IC-484658, IC-485143, IC-484491, IC-485202, IC-585219, IC-240880, IC-484430, IC-585225, IC-484696, IC-585233, IC-527019, IC-436857, IC-436867, IC-436916
Height of plant up to the base of flag leaf	
Very short (<76 cm) (31)	IC-484430, IC-240860, IC-240861, IC-240862, IC-240871, IC-240880, IC-240872, IC-484418, IC-485003, IC-240866, IC-484351, IC-484895, IC-240865, IC-484637, IC-240864, IC-240884, IC-484767, IC-484489, IC-240877, IC-240879, IC-484696, EC-486333, IC-240845, IC-484911, IC-240856, IC-484583, IC-484750, IC-240883, IC-436857, IC-436867, IC-436916
Short (76-150 cm) (107)	IC-484729, IC-240881, IC-485143, IC-484658, IC-240848, IC-485145, IC-485024, IC-240846, IC-484714, IC-484855, IC-296496, IC-240859, IC-436796, IC-484444, IC-240852, IC-484974, IC-485177, IC-397246, IC-484491, IC-485009, IC-484997, IC-413297, IC-240855, IC-484869, IC-527019, IC-485011, IC-485023, IC-485002, IC-485180, IC-485028, IC-484591, EC-464430, IC-585225, IC-240876, IC-484510, IC-484445, IC-240843, IC-585177, IC-585143, IC-585218, IC-485202, IC-485039, IC-395816, IC-484860, IC-436791, IC-585176, IC-585174, IC-485233, IC-298601, IC-436577, IC-484989, IC-240849, IC-436523, IC-240831, IC-585205, IC-485030, IC-585201, IC-585234, IC-484826, IC-240832, IC-546929, IC-585239, IC-484628, IC-298598, IC-395722, IC-240841, IC-240833, IC-585219, IC-485188, IC-436752, IC-527022, IC-121559, IC-240837, IC-585195, IC-484819, IC-585185, IC-585240,

	IC-413299, IC-309907, IC-353607, IC-240840, IC-240842, IC-309906, IC-585209, IC-240838, IC-309905, IC-485244, IC-585193, IC-298605, IC-484968, IC-585204, IC-240851, IC-585180, IC-309914, IC-436572, IC-309944, IC-585197, IC-240850, IC-585233, IC-240839, IC-240835, IC-484870, IC-484320, IC-585192, IC-585198, IC-585189, IC-436682
Medium (151-225 cm) (12)	IC-585184, IC-585196, IC-585194, IC-585203, IC-585202, IC-585190, IC-484962, IC-240853, IC-585191, IC-436527, IC-585200, IC-484515
Flag leaf yellow colouration of mid rib	
Present (40)	IC-485180, IC-484860, IC-121559, IC-484320, IC-484962, IC-240837, IC-240840, IC-240841, IC-240845, IC-240853, IC-240855, IC-240856, IC-240859, IC-240871, IC-240877, IC-485023, IC-485028, IC-484819, IC-484869, IC-484870, IC-484989, IC-485003, IC-485009, IC-485011, IC-484583, IC-485145, IC-484637, IC-485233, IC-298598, IC-298601, IC-353607, IC-585198, IC-585200, IC-585233, IC-395722, IC-436527, IC-436572, IC-397246, IC-240848, IC-436857
Absent (110)	EC-486333, IC-546929, IC-484895, IC-484968, IC-485002, IC-485024, IC-240831, IC-240832, IC-240833, IC-240835, IC-240838, IC-240839, IC-240842, IC-240843, IC-240846, IC-240849, IC-240850, IC-240851, IC-240852, IC-240860, IC-240861, IC-240862, IC-240864, IC-240865, IC-240866, IC-240872, IC-240876, IC-240879, IC-240880, IC-240881, IC-240883, IC-240884, IC-484974, IC-485030, IC-485039, IC-484911, IC-484997, IC-485244, IC-484515, IC-484628, IC-484696, IC-484714, IC-485177, IC-484591, IC-484729, IC-484750, IC-484767, IC-484826, IC-484855, IC-484351, IC-484418, IC-484430, IC-484444, IC-484445, IC-484489, IC-484491, IC-484510, IC-484658, IC-485143, IC-485188, IC-485202, EC-464430, IC-298605, IC-309905, IC-309906, IC-309907, IC-309914, IC-309944, IC-585143, IC-585174, IC-585176, IC-585177, IC-585180, IC-585184, IC-585185, IC-585189, IC-585190, IC-585191, IC-585192, IC-585193, IC-585194, IC-585195, IC-585196, IC-585197, IC-585201, IC-585202, IC-585203, IC-585204, IC-585205, IC-585209, IC-585218, IC-585219, IC-585225, IC-585234, IC-585239, IC-585240, IC-296496, IC-395816,IC-413297, IC-413299, IC-436523, IC-436577, IC-527019, IC-527022, IC-436682, IC-436752, IC-436791, IC-436796, IC-436867, IC-436916
Lemma arista formation	
Present (63)	IC-484860, IC-546929, IC-121559, IC-484320, IC-484962, IC-484968, IC-485002, IC-485009, IC-484515, IC-484628, IC-484696, IC-484591,IC-484729,IC-484750, IC-484826, IC-484489, IC-484491, IC-484658, IC-485143, IC-298605, IC-309905, IC-309906, IC-309907, IC-309914, IC-309944, IC-353607, IC-585143, IC-585174, IC-585176, IC-585177, IC-585180, IC-585184, IC-585185, IC-585189, IC-585190, IC-585191, IC-585192, IC-585193, IC-585194, IC-585195, IC-585196, IC-585197, IC-585198, IC-585200, IC-585202, IC-585203, IC-585204, IC-585205, IC-585233, IC-585240, IC-296496, IC-395722, IC-395816, IC-436523, IC-436527, IC-436572, IC-436577, IC-527019, IC-527022, IC-436682, IC-436791, IC-436796, IC-436867
Absent (87)	IC-485180, EC-486333, IC-484895, IC-485024, IC-240831, IC-240832, IC-240833, IC-240835, IC-240837, IC-240838, IC-240839, IC-240840, IC-240841, IC-240842, IC-240843, IC-240845, IC-240846, IC-240848, IC-240849, IC-240850, IC-240851, IC-240852, IC-240853, IC-240855, IC-240856, IC-240859, IC-240860, IC-240861, IC-240862, IC-240864, IC-240865, IC-240866, IC-240871, IC-240872, IC-240876, IC-240877, IC-240879, IC-240880, IC-240881, IC-240883, IC-240884, IC-484974, IC-485023, IC-485028, IC-485030, IC-485039, IC-484819, IC-484869, IC-484870, IC-484911, IC-484989, IC-484997, IC-485003, IC-485011, IC-485244, IC-484583, IC-484714, IC-485145, IC-485177, IC-484767, IC-484855, IC-484351, IC-484418, IC-484430, IC-484444, IC-484445, IC-484510, IC-484637, IC-485188, IC-485202, IC-485233, EC-464430, IC-298598, IC-298601, IC-585201, IC-585209, IC-585218, IC-585219, IC-585225, IC-585234, IC-585239, IC-413297, IC-413299, IC-397246, IC-436752, IC-436857, IC-436916
Stigma anthocyanin colouration	
Present (125)	IC-485180,EC-486333,IC-546929, IC-121559, IC-484320, IC-484895, IC-484962, IC-485002, IC-485024, IC-240832, IC-240833, IC-240835, IC-240837, IC-240838, IC-240839, IC-240840, IC-240841, IC-240843, IC-240846, IC-240848, IC-240849, IC-240850, IC-240851, IC-240853, IC-240855, IC-240856, IC-240859, IC-240865, IC-240866, IC-240872, IC-240876, IC-240879, IC-240880, IC-240881, IC-240883, IC-240884, IC-484974, IC-485023, IC-485028, IC-485030, IC-484819, IC-484869, IC-484870, IC-484911, IC-484997, IC-485003, IC-485009, IC-485011, IC-485244, IC-484515, IC-484583, IC-484628, IC-484696, IC-484714, IC-485145, IC-484591, IC-484729, IC-484750, IC-484767, IC-484826, IC-484855, IC-484351, IC-484418, IC-484430, IC-484444, IC-484445, IC-484491, IC-484637, IC-484658, IC-485143, IC-485188, IC-485202, IC-485233,EC-464430,IC-298598, IC-298601, IC-298605, IC-309905, IC-309906, IC-309907, IC-309914, IC-309944, IC-353607, IC-585143, IC-585174, IC-585176, IC-585177, IC-585180, IC-585184, IC-585185, IC-585190, IC-585191, IC-585192, IC-585193, IC-585194, IC-585195, IC-585196, IC-585197, IC-585198, IC-585200, IC-585201, IC-585202, IC-585203, IC-585205, IC-585209, IC-585234, IC-585239, IC-585240, IC-395722, IC-395816, IC-413297, IC-413299, IC-436523, IC-436527, IC-436572, IC-527019, IC-527022, IC-397246, IC-436682, IC-436752, IC-436791, IC-436796, IC-436857, IC-436867, IC-436916
Absent (25)	IC-484860, IC-484968, IC-240831, IC-240842, IC-240845, IC-240852, IC-240860, IC-240861, IC-240862, IC-240864, IC-240871, IC-240877, IC-485039, IC-484989, IC-485177, IC-484489, IC-484510, IC-585189, IC-585204, IC-585218, IC-585219, IC-585225, IC-585233, IC-296496, IC-436577
Stigma yellow colouration	
Present (33)	IC-484320, IC-484962, IC-240859, IC-240866, IC-240880, IC-240884, IC-485028, IC-484869, IC-484870, IC-485003, IC-485244, IC-484767, IC-484418, IC-484489, IC-484491, IC-484510, IC-484658, IC-485143, IC-485188, IC-485202, IC-298605, IC-309906, IC-585176, IC-585194, IC-585201, IC-585202, IC-585209, IC-585239, IC-395816, IC-436577, IC-436752, IC-436796, IC-436916
Absent (117)	IC-485180,EC-486333, IC-484860, IC-546929, IC-121559, IC-484895, IC-484968, IC-485002, IC-485024, IC-240831, IC-240832, IC-240833, IC-240835, IC-240837, IC-240838, IC-240839, IC-240840, IC-240841, IC-240842, IC-240843, IC-240845, IC-240846, IC-240848, IC-240849, IC-240850, IC-240851, IC-240852, IC-240853, IC-240855, IC-240856, IC-240860, IC-240861, IC-240862, IC-240864, IC-240865, IC-240871, IC-240872, IC-240876, IC-240877, IC-240879, IC-240881, IC-240883, IC-484974, IC-485023, IC-485030, IC-485039, IC-484819, IC-484911, IC-484989, IC-484997, IC-485009, IC-485011, IC-484515, IC-484583, IC-484628, IC-484696, IC-484714, IC-485145, IC-485177, IC-484591, IC-484729, IC-484750, IC-484826, IC-484855, IC-484351, IC-484430, IC-484444, IC-484445, IC-484637, IC-485233, EC-464430, IC-298598, IC-298601, IC-309905, IC-309907, IC-309914, IC-309944, IC-353607, IC-585143, IC-585174, IC-585177, IC-585180, IC-585184, IC-585185, IC-585189, IC-585190, IC-585191, IC-585192, IC-585193, IC-585195, IC-585196, IC-585197, IC-585198, IC-585200, IC-585203, IC-585204, IC-585205, IC-585218, IC-585219, IC-585225, IC-585233, IC-585234, IC-585240, IC-296496, IC-395722, IC-413297, IC-413299, IC-436523, IC-436527, IC-436572, IC-527019, IC-527022, IC-397246, IC-436682, IC-436791, IC-436857, IC-436867
Stigma length	
Short (<1mm) (51)	IC-484320, IC-484895, IC-485024, IC-240831, IC-240832, IC-240835, IC-240837, IC-240838, IC-240839, IC-240842, IC-240845, IC-240846, IC-240848, IC-240849, IC-240850, IC-240851, IC-240852, IC-240853, IC-240855, IC-240856, IC-240862, IC-240864, IC-240871, IC-240872, IC-240879, IC-484974, IC-485023, IC-485039, IC-484989, IC-484997, IC-485003, IC-484714, IC-485177, IC-484767, IC-484855, IC-484351, IC-484430, IC-484444, IC-484445, IC-484510, IC-485143, IC-485202, IC-485233, IC-585143, IC-585201, IC-585225, IC-296496, IC-413297, IC-413299,IC-436523,IC-436916
Medium (1-2mm) (50)	IC-485180, EC-486333, IC-484860, IC-546929, IC-484962, IC-484968, IC-240833, IC-240840, IC-240859, IC-240860, IC-240861, IC-240866, IC-240876, IC-240877, IC-240880, IC-240881, IC-240883, IC-240884, IC-485028, IC-485030, IC-484819, IC-484869, IC-484870, IC-484911, IC-485145, IC-484418, IC-484489, IC-484491, IC-484637, IC-485188, IC-309905, IC-309906, IC-309907, IC-585177, IC-585184, IC-585185, IC-585190, IC-585194, IC-585198, IC-585200, IC-585204, IC-585219, IC-585234, IC-585240, IC-436577, IC-527019, IC-527022, IC-436752, IC-436857, IC-436867

Long (>2mm) (49)	IC-121559, IC-485002, IC-240841, IC-240843, IC-240865, IC-485009, IC-485011, IC-485244, IC-484515, IC-484583, IC-484628, IC-484696, IC-484591, IC-484729, IC-484750, IC-484826, IC-484658, EC-464430, IC-298598, IC-298601, IC-298605, IC-309914, IC-309944, IC-353607, IC-585174, IC-585176, IC-585180, IC-585189, IC-585191, IC-585192, IC-585193, IC-585195, IC-585196, IC-585197, IC-585202, IC-585203, IC-585205, IC-585209, IC-585218, IC-585233, IC-585239, IC-395722, IC-395816, IC-436527, IC-436572, IC-397246, IC-436682, IC-436791, IC-436796
Flower withpedicel: length of flower	
Very short (4)	IC-484583, IC-484658, IC-353607, IC-436682
Short (12)	IC-240850, IC-240884, IC-484870, IC-484515, IC-484510, IC-485202, EC-464430, IC-298601, IC-585197, IC-585233, IC-436796, IC-436857
Medium (53)	EC-486333, IC-121559, IC-485002, IC-240831, IC-240832, IC-240833, IC-240841, IC-240843, IC-240846, IC-240848, IC-240849, IC-240851, IC-240852, IC-240860, IC-240865, IC-240871, IC-240872, IC-240876, IC-240880, IC-240883, IC-484974, IC-485028, IC-485030, IC-484869, IC-484911, IC-485003, IC-485145, IC-484591, IC-484729, IC-484750, IC-484767, IC-484855, IC-484430, IC-484444, IC-484445, IC-484637, IC-309907, IC-309914, IC-585143, IC-585176, IC-585180, IC-585189, IC-585193, IC-585196, IC-585202, IC-585203, IC-585209, IC-585234, IC-395816, IC-413297,IC-413299, IC-436577, IC-397246
Long (71)	IC-485180, IC-484860, IC-546929, IC-484320, IC-485024, IC-240835, IC-240837, IC-240838, IC-240839, IC-240840, IC-240842, IC-240845, IC-240853, IC-240855, IC-240856, IC-240861, IC-240862, IC-240864, IC-240866, IC-240877, IC-240879, IC-240881, IC-485023, IC-485039, IC-484819, IC-484989, IC-485009, IC-485011, IC-485244, IC-484628, IC-484714, IC-485177, IC-484826, IC-484351, IC-484418, IC-484489, IC-484491, IC-485143, IC-485188, IC-485233, IC-298598, IC-298605, IC-309906, IC-585174, IC-585177, IC-585184, IC-585185, IC-585190, IC-585191, IC-585192, IC-585194, IC-585195, IC-585198, IC-585200, IC-585204, IC-585205, IC-585218, IC-585225, IC-585239, IC-585240, IC-296496, IC-395722, IC-436523, IC-436527, IC-436572, IC-527019, IC-527022, IC-436752, IC-436791, IC-436867, IC-436916
Very long (10)	IC-484895, IC-484962, IC-484968, IC-240859, IC-484997, IC-484696, IC-309905, IC-309944, IC-585201, IC-585219
Anther length	
Short (<3mm) (125)	EC-486333,IC-484860, IC-546929, IC-121559, IC-484320, IC-484895, IC-484962, IC-485002, IC-485024, IC-240831, IC-240832, IC-240833, IC-240835, IC-240837, IC-240838, IC-240839, IC-240840, IC-240841, IC-240842, IC-240843, IC-240845, IC-240846, IC-240848, IC-240849, IC-240850, IC-240851, IC-240852, IC-240853, IC-240855, IC-240859, IC-240860, IC-240861, IC-240862, IC-240864, IC-240865, IC-240871, IC-240872, IC-240876, IC-240877, IC-240879, IC-240880, IC-240881, IC-240883, IC-240884, IC-484974, IC-485023, IC-485028, IC-485030, IC-485039, IC-484819, IC-484869, IC-484870, IC-484911, IC-484989, IC-484997, IC-485003, IC-485244, IC-484515, IC-484583, IC-484628, IC-484714, IC-485145, IC-484591, IC-484729, IC-484750, IC-484767, IC-484826, IC-484351, IC-484418, IC-484430, IC-484444, IC-484445, IC-484637, IC-484658, IC-485143, IC-485188, IC-485233, EC-464430, IC-298598, IC-298601, IC-298605, IC-309905, IC-309906, IC-309907, IC-309914, IC-309944, IC-353607, IC-585143, IC-585174, IC-585176, IC-585177, IC-585184, IC-585185, IC-585189, IC-585191, IC-585192, IC-585193, IC-585194, IC-585195, IC-585196, IC-585197, IC-585200, IC-585203, IC-585205, IC-585209, IC-585218, IC-585219, IC-585225, IC-585233, IC-585234, IC-585239, IC-585240, IC-296496, IC-395816, IC-413297, IC-413299, IC-436527, IC-436577, IC-527019, IC-527022, IC-397246, IC-436682, IC-436752, IC-436791, IC-436857
Medium (3-4mm) (25)	IC-485180, IC-484968, IC-240856, IC-240866, IC-485009, IC-485011, IC-484696, IC-485177, IC-484855, IC-484489, IC-484491, IC-484510, IC-485202, IC-585180, IC-585190, IC-585198, IC-585201, IC-585202, IC-585204, IC-395722, IC-436523, IC-436572, IC-436796, IC-436867, IC-436916
Anther colour of dry anther	
Yellow orange (45)	IC-485180, EC-486333, IC-484968, IC-240843, IC-240860, IC-240861,IC-240877, IC-240879, IC-484974, IC-485145, IC-485177, IC-484750,IC-484826, IC-484855, IC-484351, IC-484444, IC-484445, IC-484489,IC-485202, IC-309905, IC-309907, IC-585143, IC-585174, IC-585177,IC-585180, IC-585184, IC-585189, IC-585190, IC-585191, IC-585193,IC-585195, IC-585196, IC-585198, IC-585219, IC-585225, IC-395816,IC-413297, IC-413299, IC-436523, IC-436572, IC-436577, IC-397246, IC-436752, IC-436791, IC-436867
Orange (82)	IC-484860, IC-546929, IC-121559, IC-485002, IC-485024, IC-240831,IC-240832, IC-240833, IC-240835, IC-240837, IC-240838, IC-240839,IC-240840, IC-240841, IC-240842, IC-240845, IC-240846, IC-240848,IC-240849, IC-240850, IC-240851, IC-240852, IC-240853, IC-240855,IC-240856, IC-240859, IC-240862, IC-240864, IC-240865, IC-240866, IC-240871, IC-240876, IC-240881, IC-240884, IC-485023, IC-485028, IC-485030, IC-485039, IC-484869, IC-484870, IC-484911,IC-484989, IC-484997, IC-485003, IC-485011, IC-485244, IC-484515,IC-484583, IC-484628, IC-484714, IC-484591, IC-484729, IC-484767,IC-484418, IC-484430, IC-484491, IC-484510, IC-484637, IC-484658,IC-485143, IC-485188, IC-485233, EC-464430, IC-309944, IC-353607,IC-585185, IC-585192, IC-585194, IC-585197, IC-585200, IC-585202,IC-585204, IC-585218, IC-585234, IC-585240, IC-296496, IC-395722, IC-527019, IC-527022, IC-436682, IC-436857, IC-436916
Red Orange (9)	IC-484320, IC-484895, IC-484962, IC-309906, IC-585201, IC-585205, IC-585209, IC-585233, IC-585239
Greyed Orange (14)	IC-436796, IC-240872, IC-240880, IC-240883, IC-484819, IC-485009, IC-484696,IC-298598,IC-298601, IC-298605, IC-309914, IC-585176, IC-585203, IC-436527
Glume colour	
Green white (22)	IC-485002, IC-485024, IC-240835, IC-240838, IC-240876, IC-240881, IC-240883, IC-485023, IC-484819, IC-484869, IC-484911, IC-485003, IC-485009, IC-485244, IC-484696, IC-485145, IC-484489, IC-484510, IC-484658, IC-485202, IC-436752, IC-436791
Yellow white (40)	IC 546929, IC-484968, IC-240832, IC-240833, IC-240839, IC-240841, IC-240842, IC-240843, IC-240845, IC-240846, IC-240851, IC-240853,IC-240855, IC-240859, IC-240860, IC-240865, IC-240871, IC-240880, IC-240884, IC-485028, IC-485039, IC-484870, IC-484997, IC-484826, IC-484855, IC-484418, IC-484430, IC-484445, IC-484637, IC-485143, IC-485188, EC-464430, IC-298598, IC-353607, IC 585218, IC 585219, IC-296496, IC-436572, IC-527022, IC-436916
Greyed yellow (18)	IC-485180, IC-121559, IC-240840, IC-240848, IC-240866, IC-240872, IC-484974, IC-485030, IC-484989, IC-484628, IC-485177, IC-484351, IC-298601, IC-298605, IC-585176, IC-395816, IC-413297, IC-436857
Greyed orange (44)	IC-484860, IC-484895, IC-484962, IC-240850, IC-240852, IC-240856, IC-240861, IC-240862, IC-240877, IC-240879, IC-485011, IC-484515, IC-484714, IC-484591, IC-484729, IC-484750, IC-484767, IC-485233, IC-309905, IC-309907, IC-309914, IC-309944, IC-585143, IC-585174, IC-585177, IC-585180, IC-585184, IC-585185, IC-585189, IC-585190, IC-585191, IC-585192, IC-585193, IC-585194, IC-585195, IC-585196, IC-585202, IC-585205, IC-585225, IC-585233, IC-395722, IC-413299, IC-436527, IC-436867
Greyed red (20)	EC-486333, IC-240831, IC-240837, IC-240849, IC-240864, IC-484444, IC-484491, IC-309906, IC-585197, IC-585198, IC-585200, IC-585203, IC-585209, IC-585234, IC-585239, IC-585240, IC-436577, IC-397246, IC-436682, IC-436796
Greyed purple (6)	IC-484320, IC-484583, IC-585201, IC-585204, IC-436523, IC-527019
Panicle length of branches	
Short (141)	IC-240872, IC-485002, IC-309907, EC-486333, IC-240833, IC-240871, IC-484911, IC-484444, IC-309906, IC-353607, IC-585176, IC-585194, IC-585195, IC-413299, IC-436523, IC-527022, IC-436682, IC-436791, IC-585204, IC-484320, IC-485188, IC-298598, IC-585185, IC-585209, IC-484860, IC-546929, IC-240842, IC-484974, IC-484591, IC-585177, IC-585234, IC-240853, IC-485023, IC-240831, IC-240860, IC-240861, IC-240866, IC-485030, IC-484869, IC-485244, IC-484714, IC-484750, IC-484418, IC-484445, IC-484491, IC-484658, IC-585189, IC-585190, IC-585193, IC-585196, IC-585197, IC-585201, IC-585202, IC-585203, IC-585218,

	IC-585225, IC-585233, IC-585240, IC-436527, IC-436572, IC-121559, IC-484895, IC-240843, IC-484870, IC-240840, IC-240865, IC-484767, IC-484826, IC-240862, IC-485009, IC-240832, IC-484968, IC-240839, IC-240841, IC-240848, IC-240850, IC-240859, IC-240883, IC-485039, IC-484696, IC-485145, IC-485233, EC-464430, IC-298601, IC-309944, IC-585143, IC-585174, IC-585198, IC-585200, IC-296496, IC-395722, IC-397246, IC-240864, IC-485024, IC-240837, IC-240851, IC-240881, IC-484430, IC-485143, IC-240835, IC-484989, IC-585205, IC-484962, IC-240838, IC-240846, IC-240849, IC-240852, IC-240879, IC-240880, IC-240884, IC-485028, IC-484819, IC-484583, IC-484628, IC-484729, IC-484489, IC-298605, IC-585180, IC-585192, IC-395816, IC-413297, IC-436577, IC-436752, IC-436796, IC-240845, IC-240877, IC-484515, IC-484637, IC-309905, IC-585191, IC-240876, IC-240855, IC-485003, IC-485011, IC-484855, IC-484351, IC-485202, IC-309914, IC-436857, IC-436867, IC-436916
Medium (9)	IC-240856, IC-484997, IC-585184, IC-485177, IC-585219, IC-585239, IC-527019, IC-484510, IC-485180
Panicle density at maturity	
Very loose (17)	IC-484962, IC-484583, IC-485177, IC-484826, IC-484855, IC-484351, IC-484418, IC-484444, IC-484445, IC-484489, IC-484491, IC-585201, IC-585205, IC-585219, IC-585239, IC-527019, IC-436752
Semi loose (29)	IC-121559, IC-484320, IC-485009, IC-484591, EC-464430, IC-298598, IC-298605, IC-309907, IC-353607, IC-585174, IC-585185, IC-585189, IC-585190, IC-585194, IC-585196, IC-585200, IC-585202, IC-585209, IC-585233, IC-585234, IC-585240, IC-413299, IC-436523, IC-436527, IC-436572, IC-527022, IC-436682, IC-436791, IC-436867
Semi compact (62)	EC-486333, IC-484860, IC-546929, IC-484895, IC-485002, IC-485024, IC-240831, IC-240832, IC-240833, IC-240835, IC-240837, IC-240838, IC-240839, IC-240840, IC-240842, IC-240843, IC-240846, IC-240848, IC-240849, IC-240850, IC-240851, IC-240852, IC-240853, IC-240855, IC-240856, IC-240860, IC-240862, IC-240866, IC-240871, IC-240877, IC-240879, IC-240880, IC-240881, IC-240883, IC-484974, IC-485028, IC-484819, IC-484870, IC-484911, IC-485003, IC-484696, IC-484714, IC-485145, IC-484729, IC-484750, IC-484767, IC-484430, IC-484510, IC-484658, IC-298601, IC-585143, IC-585176, IC-585184, IC-585192, IC-585203, IC-585204, IC-585218, IC-395722, IC-413297, IC-397246, IC-436796, IC-436857
Compact (42)	IC-485180, IC-484968, IC-240841, IC-240845, IC-240859, IC-240861, IC-240864, IC-240865, IC-240872, IC-240876, IC-240884, IC-485023, IC-485030, IC-485039, IC-484869, IC-484989, IC-484997, IC-485011, IC-485244, IC-484515, IC-484628, IC-484637, IC-485143, IC-485188, IC-485202, IC-485233, IC-309905, IC-309906, IC-309914, IC-309944, IC-585177, IC-585180, IC-585191, IC-585193, IC-585195, IC-585197, IC-585198, IC-585225, IC-296496, IC-395816, IC-436577, IC-436916
Panicle shape	
Reversed pyramid (19)	IC-484583, IC-485177, IC-484430, IC-484445, IC-484489, IC-484491, IC-484510, IC-484658, IC-485143, IC-485188, IC-485202, IC-585180, IC-585219, IC-585233, IC-585234, IC-585240, IC-436577, IC-527019, IC-436752
Panicle broader in upperpart (68)	IC-485180, IC-484860, IC-546929, IC-484962, IC-484968, IC-485002, IC-485024, IC-240831, IC-240832, IC-240833, IC-240835, IC-240840, IC-240841, IC-240851, IC-240852, IC-240855, IC-240856, IC-240862, IC-240864, IC-240865, IC-240866, IC-240871, IC-240876, IC-240877, IC-24087, IC-240880, IC-240883, IC-484974, IC-485023, IC-485030, IC-485039, IC-484869, IC-484870, IC-484911, IC-484989, IC-484997, IC-485003, IC-485009, IC-485011, IC-485244, IC-484515, IC-484628, IC-484696, IC-484729, IC-484826, IC-484855, IC-484351, IC-484637, IC-298601, IC-309905, IC-309906, IC-309907, IC-309914, IC-309944, IC-585176, IC-585177, IC-585193, IC-585195, IC-585200, IC-585201, IC-585202, IC-585203, IC-585204, IC-585225, IC-395722, IC-436523, IC-527022, IC-436796
Symmetric (39)	EC-486333, IC-484895, IC-240837, IC-240838, IC-240839, IC-240842, IC-240843, IC-240845, IC-240846, IC-240848, IC-240849, IC-240850, IC-240853, IC-240860, IC-240861, IC-240872, IC-240881, IC-240884, IC-485028, IC-484819, IC-484714, IC-485145, IC-484750, IC-484767, IC-484418, IC-485233, EC-464430, IC-298605, IC-585143, IC-585174, IC-585205, IC-296496, IC-413297, IC-413299, IC-436527, IC-397246, IC-436857, IC-436867, IC-436916
Panicle broader in lower part (13)	IC-121559, IC-484320, IC-240859, IC-484444, IC-298598, IC-353607, IC-585185, IC-585191, IC-585192, IC-585194, IC-585196, IC-436572, IC-436791
Pyramidal (11)	IC-484591, IC-585184, IC-585189, IC-585190, IC-585197, IC-585198, IC-585209, IC-585218, IC-585239, IC-395816, IC-436682
Neck of panicle visible above sheath	
Very short (<5.1cm) (54)	IC-484968, IC-240846, IC-240848, IC-240849, IC-240880, IC-240881, IC-484819, IC-484870, IC-484997, IC-485009, IC-484444, IC-485188, IC-585184, IC-585192, IC-585193, IC-585194, IC-585196, IC-585198, IC-585202, IC-585218, IC-585219, IC-240876, IC-240872, IC-485028, IC-585239, IC-240852, IC-484860, IC-484750, IC-585189, IC-585209, IC-121559, IC-240838, IC-240851, IC-298598, IC-436791, IC-485030, IC-240879, IC-585204, IC-436796, IC-485143, IC-485180, IC-485002, IC-240840, IC-240859, IC-240871, IC-484974, IC-298601, IC-309944, IC-585143, IC-585233, IC-436523, IC-436527, IC-436867, IC-436916
Short (5.1-10 cm) (40)	IC-240839, IC-485011, EC-464430, IC-309906, IC-395816, IC-240845, IC-585180, IC-585174, IC-585191, IC-585203, IC-585240, IC-546929, IC-240853, IC-240855, IC-240856, IC-485023, IC-309907, IC-527022, IC-436682, IC-484714, IC-485145, IC-484637, IC-298605, IC-585176, IC-585195, IC-585200, IC-413297, IC-485024, IC-485039, IC-585190, IC-585234, IC-240835, IC-240861, IC-484869, IC-484911, IC-484696, IC-484491, IC-309914, IC-353607, IC-395722
Medium (10.1-15 cm) (29)	IC-240837, IC-240842, IC-240864, IC-484826, IC-485233, IC-585201, IC-436572, IC-484895, IC-240862, IC-240865, IC-484515, IC-585185, IC-397246, IC-436752, EC-486333, IC-436577, IC-240833, IC-484591, IC-585225, IC-240831, IC-240860, IC-240883, IC-240884, IC-296496, IC-484418, IC-484510, IC-309905, IC-585197, IC-436857
Long (15.1-20 cm) (18)	IC-484628, IC-240877, IC-484989, IC-485244, IC-485202, IC-240832, IC-240841, IC-413299, IC-527019, IC-240866, IC-585177, IC-585205, IC-240850, IC-240843, IC-484767, IC-485003, IC-484855, IC-484658
Very long (>20 cm) (9)	IC-484729, IC-484445, IC-484489, IC-484320, IC-485177, IC-484962, IC-484351, IC-484583, IC-484430
Glume length	
Very short (26)	IC-485180, EC-486333, IC-484895, IC-485024, IC-240831, IC-240832, IC-240841, IC-240845, IC-240846, IC-240849, IC-240850, IC-240851, IC-240852, IC-240853, IC-240862, IC-240864, IC-240871, IC-240872, IC-240879, IC-485023, IC-484989, IC-484714, IC-484767, EC-464430, IC-436682, IC-436791
Short (18)	IC-546929, IC-485002, IC-240833, IC-240838, IC-240840, IC-240842, IC-240860, IC-240884, IC-484591, IC-484729, IC-484750, IC-484351, IC-309914, IC-585189, IC-585192, IC-585198, IC-585203, IC-436916
Medium (68)	IC-484860, IC-121559, IC-484968, IC-240835, IC-240837, IC-240839, IC-240843, IC-240855, IC-240856, IC-240859, IC-240861, IC-240865, IC-240876, IC-240877, IC-240880, IC-240881, IC-484974, IC-485028, IC-485030, IC-485039, IC-484819, IC-484869, IC-484870, IC-484911, IC-484997, IC-485011, IC-485244, IC-484628, IC-484696, IC-485145, IC-484855, IC-484418, IC-298601, IC-298605, IC-309905, IC-309944, IC-353607, IC-585143, IC-585174, IC-585176, IC-585184, IC-585185, IC-585190, IC-585191, IC-585193, IC-585194, IC-585195, IC-585197, IC-585200, IC-585201, IC-585204, IC-585205, IC-585218, IC-585219, IC-585239, IC-296496, IC-395722, IC-413297, IC-413299, IC-436523, IC-436572, IC-436577, IC-527019, IC-527022, IC-436752, IC-436796, IC-436857, IC-436867
Long (28)	IC-484320, IC-484962, IC-240848, IC-240866, IC-240883, IC-485003, IC-485009, IC-484515, IC-484826, IC-484430, IC-484445, IC-484489, IC-484491, IC-484637, IC-485143, IC-485188, IC-485202, IC-485233, IC-298598, IC-309906, IC-309907, IC-585177, IC-585180, IC-585196, IC-585202, IC-395816, IC-436527, IC-397246
Very long (10)	IC-484583, IC-485177, IC-484444, IC-484510, IC-484658, IC-585209, IC-585225, IC-585233, IC-585234, IC-585240

genotypes).Based on stigma anthocyanin colouration genotypes were classified into two categories *viz.,* present (125 genotypes) and absent (25 genotypes). Based on stigma yellow colouration genotypes were classified into two categories *viz.,* present (33 genotypes) and absent (117 genotypes). Based on stigma length genotypes were classified into three categories Viz., short (51 genotypes), medium (50 genotypes) and long (49 genotypes). Based on flower with pedicel length of flower genotypes were classified into five categories *viz.,* very short (4 genotypes), short (12 genotypes), medium (53 genotypes), long (71 genotypes) and very long (10 genotypes. Based on anther length genotypes were classified into two categories *viz.,* short (125 genotypes) and medium (25 genotypes). Based on colour of dry anther, genotypes were classified into four categories *viz.,* yellow orange (45 genotypes), orange (82 genotypes), red orange (9 genotypes) and grayed orange (14 genotypes). Results were reported by Kolberg (1999) characterized 124 accessions of sorghum using IPGRI descriptors. Reddy *et al.* (2009) and Joshi *et al.* (2009) characterized 269, 26 and 29 sorghum genotypes using DUS guidelines for sorghum, respectively.

Physiological maturity

Characters like, glume colour, panicle length of branches, panicle density at maturity, panicle shape, neck of panicle visible above sheath, glume length and grain threshability were recorded for characterization of genotypes at physiological maturity. On the basis of glume colour genotypes were categorized into six groups *viz.,* green white (22 genotypes), yellow white (40 genotypes), grayed yellow (18 genotypes), grayed orange (44 genotypes), grayed red (20 genotypes), grayed purple (6 genotypes). On the basis of panicle length of branches genotypes were categorized into two groups *viz.,* short (141 genotypes) and medium (9 genotypes). On the basis of panicle density at maturity genotypes were divided into four categories *viz.,* very loose (17 genotypes), semi loose (29 genotypes), semi compact (62 genotypes) and compact (42 genotypes). On the basis panicle shape genotypes were characterized into five groups*viz.,* reverse pyramid (19 genotypes), panicle broader in upper part (68 genotype), symmetrical (39 genotypes), panicle broader in lower part (13 genotypes) and pyramidal (11 genotypes). On the basis of neck of panicle visible above sheath genotypes were grouped into five groups namely, very short (54 genotypes), short (40 genotypes), medium (29 genotypes), long (18 genotypes) and very long (9 genotypes). On the basis of glume length genotypes were grouped into five groups namely, very short (26 genotypes), short (18 genotypes), medium (68 genotypes), long (28 genotypes) and very long (10 genotype).On the basis of threshability in three categories *viz.,* freely threshable (112 genotypes), partly threshable (29 genotypes) and difficult to thresh (9 genotypes). Similar results were reported by Pahuja *et al.* (2002) evaluated 18 sorghum hybrids on the basis of plant height. Umakanth *et al.* (2002) for plant height and panicle length.Sangwan *et al.* (2005) for panicle compactness and shape of panicle. Elangovan *et al.* (2006) for ear head compactness, ear head shape, glume colour, ear head length and plant height. Nabi *et al.* (2006) for stem thickness, plant height and leaf area. Reddy *et al.* (2009) for plant height and panicle length.Missihoun *et al.* (2015) for color of glume, panicle type.

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