RESEARCH ARTICLE

MORPHOLOGICAL CHARACTERIZATION OF SESAME (*SESAMUM INDICUM* L.) GENOTYPES USING DUS DESCRIPTORS

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Received-09.06.2020, Revised-28.06.2020

Abstract: The aim of present investigation is to characterize 30 sesame genotypes (25 advanced breeding lines and 5 released varieties) based on DUS characteristics of Protection of Plant Varieties & Farmers' Rights Authority (PPV & FRA). The field experiment was conducted at Agricultural Research Station, Yelamanchili, Visakhapatnam District of Andhra Pradesh and twenty DUS descriptors were recorded in the genotypes. The study revealed the presence of significant variation for days to 50% flowering, plant height, branching, stem hairiness, leaf lobes, capsule hairiness, capsule length (cm), days to maturity, seed coat colour, 1000 seed weight (gm) and oil content (%) indicating variations due to genetic makeup of the lines and these descriptors can be utilized in genotype identification, characterization and maintenance.

Keywords: Genotypes, Morphological characterize, *Sesamum indicum*

INTRODUCTION

Sesame (2n=26) is a member of the family Pedaliaceae and is considered as one of the most ancient oil seed crops. Sesame is cultivated in tropical, subtropical and Southern temperate regions of the world, but mainly in Asia, Africa, and South America (Anilakumar *et al*., 2010). Sesame is mainly cultivated for its seeds as they are very nutritious with almost 50% oil and up to 25% protein content. It ranks fifth among annual oil crops and eighth among all consumable oil crops at world level (Wongyai, 2007). The species deserves its reputation as "queen of the oil seeds" because of its oil's resistance to oxidative deterioration and high unsaturated fatty acid content (85%). The excellent stability of sesame oil is attributed to the presence of antioxidant lignans such as sesamin and sesamolin. The health benefits of these compounds, including antioxidants, antiaging, antihypertensive, anticancer, cholesterol lowering, and antimutagenic properties of seeds are reported by several authors (Anilakumar *et al*., 2010). Sesame is cultivated in an area of 10 million hectare with a production of 5.53 million tonnes at the world level (FAOSTAT, 2017). Over 80% sesame producing areas are in the developing countries *i.e*., Myanmar (890,000 tons), India (636,000 tons), China (588,000 tons), Sudan (562,000 tons) and Tanzania (420,000 tons).

Morpho-agronomic traits are the primary variables to study the genetic differences among the sesame genotypes (Bishit *et al*., 1998 and Singh *et al*., 2017). The introduction of International Union for the Protection of New Varieties of Plants (UPOV) and World Trade Organization (WTO) rules and regulation has made varietal identification and protection very easy as the standards are same in all the countries. The DUS characteristics of BioVersity International are followed for characterization of crops at the International level while in India the descriptors of Protection of Plant Varieties & Farmers' Rights Authority (PPV &FRA) are used for the characterization of germplasm/ varieties/ lines for their maintenance, protection and identification. Thus, DUS characterization forms important criteria for genotype identification, characterization and maintenance. The present study was undertaken to characterize the advanced lines of sesame using DUS descriptors.

MATERIALS AND METHODS

Thirty (25 advanced lines and 5 released varieties) sesame genotypes were grown in a randomized complete block design replicated thrice at Agricultural Research Station, Yelamnchili during *kharif*, 2018. The distance between rows was maintained at 30cm and plant to plant was 15cm. The crop was raised under recommended package of practices along with prophylactic protection measures. The observations were recorded on DUS descriptors of PPV&FRA *i.e*., days to 50% flowering, petal colour, petal hairiness, plant height, plant branching, branching pattern, stem hairiness, leaf size, leaf lobes, leaf serration, capsule hairiness, locule number per capsule, capsule shape, capsule number per leaf axil, capsule arrangement, capsule length, days to maturity and seed coat colour.

RESULTS AND DISCUSSION

The present study of morphological characterization of sesame genotypes revealed significant variation among the genotypes *i.e.*, eleven out of 20 characters

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recorded. The characters *i.e*., days to 50% flowering, plant height, branching, stem hairiness, leaf lobes, capsule hairiness, capsule length (cm), days to maturity, seed coat colour, 1000 seed weight (gm) and oil content (%) showed sufficient variability in the lines indicating their use in characterization studies and no variation was observed for the characters *i.e.*, branching pattern (basal pattern), leaf size (large), leaf serration (serrate), flower petal colour (light purple), flower petal hairiness (dense), locule number/capsule (four), capsule shape (broad oblong), capsule number/leaf axil (one) and capsule arrangement (alternate).

The genotypes, MLTS-2, MLTS-4, MLTS-5 andYLM-152, were characterized as early types based on days to 50 per cent flowering which can be exploited in the development of short duration types while the genotypes, YLM-157, YLM-158, YLM-159 and YLM-163 were noted as late types. Remaining genotypes were reported as medium types. These are results in consonance with the previous reports of Shrivastav and Kaushal (1972), Abate and Mekbib (2015), Abdou *et al*. (2015) and Singh *et al*. (2017).

The genotypes were categorized into medium (TKG-22 and YLM-149) based on plant height and other genotypes were tall types. As the number of capsules per plant is more in the tall types, this is considered as one of the important yield contributing character. The authors, Parameshwarappa *et al*. (2008), Gidey *et al*. (2012), Menzir (2012), Tripathi *et al*. (2013) and Kiranmayi *et al*. (2016) also exploited this trait in characterization of genotypes in sesame.

The DUS characteristic, number of branches per plant, characterized the genotypes, YLM-154, YLM-156, YLM-163 and YLM-164, into medium branching types and the other genotypes showed profuse branching indicating their usefulness in plant breeding programmes as this is considered as one of the important yield contributing trait. These results are similar to the results reported by Ramachandra *et al*. (1972), Shadakshari *et al*. (1985) and Valarmathi *et al*. (2003).

Stem hairiness was absent in 10 genotypes *i.e*., YLM-149, YLM-153, YLM-17,YLM-66,YLM-157,YLM-161, YLM-163, GOURI, MADHAVI and YLM-11 while the other genotypes showed sparse hairiness. This trait is considered to be very useful in characterization and it provides resistance/ tolerance to biotic and abiotic stresses. Kashiram (1930), Mohammed and Alam (1933), Bishit *et al*. (1998), Furat and Uzun (2010), Fray *et al*. (2015), Ozcinar and Sogut (2017) and Singh *et al*. (2017) also exploited this trait during their studies on characterization of sesame genotypes.

The trait, leaf lobes, characterized the genotypes into slightly lobed to deeply lobed. The genotypes, TKG-22, YLM-148 andYLM-11, recorded slightly lobed leaves while the other genotypes had the deeply lobed leaves. This trait is having direct effect on the photosynthesis and provides selective advantage in the use of irradiance to the function of petiole as vertical spacer in conditioning the competition to light. This plays an important role in increasing the biomass of the plant and useful for easy characterization of genotypes. Singh *et al*. (2017) also used this trait as one of the criteria for characterization of genotypes in sesame.

The DUS characteristic, capsule hairiness, was observed on the genotypes and the genotypes were categorized into absent, sparse and dense types. Capsule hairiness was absent in the genotypes, GOURI, MADHAVI and YLM-11, while the genotypes, MLTS-7, YLM-152, YLM-153, YLM-154, YLM-155 and YLM-156, showed dense hairiness. The remaining genotypes recorded sparse hairiness on the capsules. This trait is considered to be useful for the pest and abitotic stress resistance/ tolerance. Rhind and Thein (1933), Mohammed and Alam (1933), Kashiram (1930), Bishit *et al*. (1998), Ercan *et al*. (2002), Valarmathi *et al*. (2003), Suhasini (2006), Parameshwarappa *et al*. (2008), Morris (2009), Furat and Uzun (2010), Fray *et al*. (2015) and Singh *et al*. (2017) also reported this trait in their studies on characterization of sesame genotypes.

The trait, capsule length, is considered to be an important yield contributing character and also used as a parameter for characterization of sesame genotypes. The genotypes were categorized into medium and long types based on capsule length. The genotypes, YLM-148 and YLM-155, recorded capsules of more than 2.5cm and grouped into long types while the other genotypes were categorized into medium types. This trait is also used for characterization in the studies of Gupta and Gupta (1977), Shadakshari *et al*. (1985), Gidey *et al*. (2012), Tripathi *et al*. (2013), Narayanan and Murugan (2013), Yahaya *et al*. (2014), Abdou *et al*. (2015), Eryigit *et al*. (2016) and Dar *et al*. (2017).

The genotypes were grouped into medium and late based on physiological maturity. The genotypes, MLTS-4, MLTS-5, MLTS-6, MLTS-7, YLM-148, YLM-151, YLM-157, YLM-163 and GOURI, recorded the maturity in between 86-95 days and considered as the late types. The other genotypes were medium in duration for days to maturity. This trait is considered to be an important parameter in selection of genotypes for cultivation based on the agronomic situations. Kashiram (1930), Mohammed and Alam (1933), Shadakshari *et al*. (1985), Parameshwarappa *et al*. (2008), Morris (2009), Gidey *et al*. (2012) and Tripathi *et al*. (2013) also utilized days to maturity as the criteria for characterization of genotypes in sesame.

The seed coat colour of genotypes is highly used trait for characterizing the genotypes and easily distinguishable trait phenotypically. The genotypes were grouped into white and dark brown types based on seed coat colour. The genotypes, TKG-22, YLM-

148, YLM-149, YLM-150, YLM-151, YLM-152, YLM153, YLM-154, YLM-155 and YLM-156, were categorized as white types and other genotypes were grouped as dark brown types, Seed coat colour is associated with antioxidant activity, disease resistance and estimating sesame evolution. The authors, Kashiram (1930), Mohammed and Alam (1933), Rhind and Thein (1933), Suhasini (2006), Arriel *et al*. (2007), Parameshwarappa *et al*. (2008), Morris (2009), Bandila *et al*. (2011), Abdou *et al*. (2015), Falusi *et al*. (2015), Fray *et al*. (2015), Kiranmayi *et al*. (2016) and Eryigit *et al*. (2016) also exploited this trait for characterization of sesame genotypes.

The trait, 1000 seed weight, is considered as an important yield contributing character and also used as descriptor in DUS characterization. In the present study, the genotypes were grouped into medium and high seed weight types based on 1000 seed weight. The genotypes, MLTS-8, YLM-148, YLM-149, YLM-150, YLM-17, YLM-161, YLM-162, YLM-163, YLM-164 and MADHAVI, were grouped as high seed weight containing types as their 1000 seed weight was more than 3.0 g while other genotypes were considered as medium types for 1000 seed weight. Similar exploitation of this trait for characterization of sesame genotypes was also mentioned by Tripathi *et al*. (2013) and Singh *et al*. (2018).

Table 1. Classification of 30 genotypes of Sesame (*Sesamum indicum* L.) on the basis of eleven variable DUS characters

S. No.	Genotypes	Days to 50% flowering	Plant height	Branching	Stem hairiness	Leaf lobes	Capsule hairiness	Capsule length	Days to maturity	Seed coat colour	1000 seed weight	Oil content
1	MLTS-1	5	7	7	3	2	3	5	5	4	5	5
2	MLTS-2	3	7	7	3	2	3	5	5	4	5	5
3	MLTS-3	5	7	7	3	2	3	5	5	4	5	5
4	MLTS-4	3	7	7	3	2	3	5	7	4	5	5
5	MLTS-5	3	7	7	3	2	3	5	7	4	5	5
6	MLTS-6	5	7	7	3	2	3	5	7	4	5	5
7	MLTS-7	5	7	7	3	2	5	5	7	4	5	5
8	MLTS-8	5	7	7	3	2	3	5	5	4	7	5
9	TKG-22	5	5	7	3	1	3	5	5	1	5	3
10	YLM-148	5	7	7	3	1	3	7	7	1	7	3
11	YLM-149	5	5	7	1	2	3	5	5	1	7	3
12	YLM-150	5	7	7	3	2	3	5	5	1	7	3
13	YLM-151	5	7	7	3	2	3	5	7	1	5	3
14	YLM-152	3	7	7	3	2	5	5	5	1	5	5
15	YLM-153	5	7	7	1	2	5	5	5	1	5	3
16	YLM-154	5	7	5	3	2	5	5	5	1	5	3
17	YLM-155	5	7	7	3	2	5	7	5	1	5	3
18	YLM-156	5	7	5	3	2	5	5	5	1	5	3
19	YLM-157	7	7	7	1	2	3	5	7	4	5	5
20	YLM-158	7	7	7	3	2	3	5	5	4	5	5
21	YLM-159	7	7	7	3	2	3	5	5	4	5	3
22	YLM-161	5	7	7	1	2	3	5	5	4	7	3
23	YLM-162	5	7	7	3	2	3	5	5	4	7	3
24	YLM-163	7	7	5	1	2	3	5	7	4	7	3
25	YLM-164	5	7	5	3	2	3	5	5	4	7	5
26	GOURI	5	7	7	1	2	1	5	7	4	5	3
27	MADHAVI	5	7	7	1	2	1	5	5	4	7	3
28	YLM-11	5	7	7	1	1	1	5	5	4	5	5
29	YLM-17	5	7	7	1	2	3	5	5	4	7	3
30	YLM-66	5	7	7	1	2	3	5	5	4	5	3
		Early (<36)-3 Medium (36-45)-5 Late (>45)-7	Short (<75)-3 Medium (75-125)-5 Tall (>125)-7	Absent-1 Few (1-2)-3 Medium (2-4)-5 Profuse branching (>4)-7	Absent-1 Sparse-3 Dense-5	Slightly lobed-1 Deeply lobed-2	Absent-1 Sparse-3 Dense-5	Short (<1.5)-3 Medium (1.5-2.5)-5 Long (2.5)-7	Early (<75)-3 Medium (76-85)-5 Late (86-95)-7 Very late (>95)-9	White-1 Grey-2 Light brown-3 Dark brown-4 Black-5	Low (<2.5)-3 Medium (2.5-3)-5 High (3.1-3.5)-7 Very high (>3.5)-9	Low (<45)-3 Medium (45-50)-5 High (>50)-7

Table 2. Genotypes and their specific DUS characteristics in sesame (*Sesamum indicum* L.).

S.No.	Genotypes	No. of Specific DUS characteristics	Specific DUS Characteristics (s)
1	MLTS-1	1	Medium Oil content
2	MLTS-2	2	Early (Days to 50% flowering) and medium oil content
3	MLTS-3	1	Medium oil content
4	MLTS-4	3	Early (Days to 50% flowering), late (Days to maturity) and medium oil content
5	MLTS-5	3	Early (Days to 50% flowering), late (Days to maturity) and medium oil content
6	MLTS-6	2	Late (Days to maturity) and medium oil content
7	MLTS-7	3	Dense capsule hairiness, late (Days to maturity) and medium oil content
8	MLTS-8	2	High (1000 seed weight) and medium oil content
9	TKG-22	3	Medium height of the main stem, slightly leaf lobed and white colour seed coat
10	YLM-148	5	Slightly leaf lobed, long capsule length, late (Days to maturity), white colour seed coat and high 1000 seed weight
11	YLM-149	4	Medium height of the main stem, absence of stem hairiness, white colour seed coat and high 1000 seed weight
12	YLM-150	2	White colour seed coat and high 1000 seed weight
13	YLM-151	2	Late (days to maturity) and white colour seed coat
14	YLM-152	4	Early (Days to 50% flowering), dense capsule hairiness, white colour seed coat, medium oil content
15	YLM-153	3	Absence of stem hairiness, dense capsule hairiness, white colour seed coat
16	YLM-154	3	Medium branching, dense capsule hairiness and white colour seed coat
17	YLM-155	3	Dense capsule hairiness, long capsule length and white colour seed coat
18	YLM-156	3	Medium branching, dense capsule hairiness and white colour seed coat
19	YLM-157	4	Late (days to50% flowering), Absent for stem hairiness, high 1000 seed weight and medium oil content
20	YLM-158	2	Late (Days to maturity) and medium oil content
21	YLM-159	1	Late days to maturity
22	YLM-161	2	Absent for stem hairiness and high 1000 seed weight
23	YLM-162	1	High 1000 seed weight
24	YLM-163	5	Late (days to50% flowering), medium branching, absence of stem hairiness, late (days to maturity) and high 1000 seed weight
25	YLM-164	3	Medium branching, high 1000 seed weight and medium oil content
26	GOURI	3	Absent for stem hairiness, capsule hairiness and late (Days to maturity)
27	MADHAVI	3	Absent for stem hairiness, capsule hairiness and high 1000 seed weight
28	YLM-11	4	Absent for stem hairiness, capsule hairiness slightly leaf lobed and medium oil content
29	YM -17	2	Absent stem hairiness and high 1000 seed weight
30	YLM-66	1	Absence of stem hairiness

The genotypes are characterized into medium and high oil containing types based on the oil percentage. The genotypes, MLTS-1, MLTS-2, MLTS-3, MLTS-4, MLTS-5, MLTS-6, MLTS-7, MLTS-8, YLM-152, YLM-157, YLM-158, YLM-164 and YLM-11, were grouped into medium oil containing types while the remaining genotypes were categorized as high oil containing genotypes. The sesame is popular for oil content and its health benefits. This trait is considered as the main economic trait of importance. Similar utilization of this trait for characterization was reported by Gidey *et al.* (2012), Tripathi *et al.*

(2013),Yahaya *et al*. (2014), and Singh *et al*. (2018). Thus, the present study revealed sufficient variation in the 30 sesame genotypes due to their genetic makeup which could be utilized in further breeding programmes for their identification, characterization and maintenance.

ACKNOWLEDGEMENT

The first author is highly grateful to Acharya NG Ranga Agricultural University for providing the stipend during the course of study.

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