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Morphological Characterization of Sesame (*Sesamum indicum* L.)

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ABSTRACT: Sesame, one of the most important oilseed crops is called as queen of oilseeds due to its high nutritional rate and presence of antioxidants. The aim of the present experiment is to evaluate 500 sesame accessions in un-replicated Augmented Block Design at Project Co-ordinating Unit (Sesame & Niger) Research farm, JNKVV campus, Jabalpur, Madhya Pradesh for two seasons during *Kharif-2019* and *2020.* Sesame accessions were characterized for nineteen morphological traits on the basis of NBPGR descriptors. Observations were recorded on leaves, stem, flowers and capsule of plants at different stages. A significant amount of variation was observed for the most of the traits studied. Results revealed divergent characteristics of sesame germplasm and indicated that morphological variation exists in the collected accessions which are helpful to a breeder for improving genetic architecture of plant. This will be highly helpful for varietal identification and conservation.

Keywords: Accessions, variation, genetic architecture.

INTRODUCTION

Sesame (*Sesamum indicum* L.) generally considered as "Queen of Oil seeds" is known by several names in different languages such as til, gingelly, benniseed, simsim, etc. It belongs to family Pedaliaceae and considered as one of the ancient oil seed crops. Sesame is cultivated in most of the regions around the world and mainly in Asia, Africa and South America (Anilakumar *et al.*, 2010). Africa has been considered as the primary centre of origin and West Asia, India, China, Japan are considered as the secondary centres of origin (Weiss, 1983). According to Joshi *et al.*, (1961), chromosome number of cultivated species of sesame has been reported as 2n=26 and it has been confirmed by several Scientists. Sesame seeds have high nutritional energy value of 6,355 kcal kg^{-1} and are high in oil and protein and comprise of 57–63 percent oil, 23–25 percent protein, 13.5 percent carbohydrate, and 5% ash, according to their chemical composition (Tunde-Akintunde and Akintunde, 2004; Elleuch *et al.*, 2007). Sesame oil has tremendous stability because it contains some natural anti oxidants such as Sesamolin, Seamin, Sesamol (Brar & Ahuja, 1979).

Cultivated sesame has observable variability in their genotypes. Germplasm plays a vital role in the crop improvement and it forms the raw material for any crop improvement programme (Upadhayay *et al.*, 2010). Considering the above point in view the main objective of this experiment is to characterize the sesame accessions based on their morphological traits. Most of the morphological traits are controlled by single gene (oligo-genic), less affected by environment and statistical analysis based on frequencies and segregation ratios.

MATERIALS AND METHODS

In the present research, a total of 500 accessions were evaluated which are collected from Project Co-ordinating Unit, All India Coordinated Research Project on Sesame and Niger (ICAR), JNKVV Campus, Jabalpur, M.P., India. Spacing between row to row and plant to plant was kept 30 cm and 10 cm. Experiment conducted using un-replicated Augmented Block Design for two seasons during *Kharif*, *2019* and *Kharif,2020*. Data were collected on 19 morphological traits *viz.*, plant growth habit, main stem color, stem hairiness, branching habit, branching pattern, leaf hairiness, leaf shape, basal leaf margin, lobe incision of basal leaf, number of flower per leaf axil, petiole colour, corolla colour, corolla hairiness, number of locules per capsule, capsule shape, capsule arrangement, capsule hairiness, dry capsule colour and type of capsule beak based on NBPGR guidelines replicating four checks.

RESULT AND DISCUSSION

Sesame being an important oil seed crop, it is annual in habitat and can be cultivated all around the year in different parts of our country. Visual observation of morphological traits on stem, leaves, flowers and capsules of plants was recorded according to NBPGR guidelines and a significant amount of variation was observed in different intensity. The sesame accessions were grouped as sparse, dense and glabrous type on the

basis of traits such as leaf hairiness, stem hairiness, corolla hairiness and capsule hairiness, broad oblong, narrow oblong capsule shape; based on the colour of stem, corolla, dry capsule accessions are grouped. The recorded observations are elucidated below

In plant growth habit trait, maximum number of accessions were observed as erect(410) followed by semi-erect(75) and prostrate(15). Plant growth habit is an important agronomic trait, because a dense ground cover affects the interception of light for photosynthetic accumulation, the inhibition of weed growth and the reduction of water evaporation from soil (Baum *et al.*, 2003). In the trait branching pattern, 458 accessions were observed as top and 42 accessions were observed as basal. At the same time in case of branching habit, maximum accessions were observed as medium(248) followed by few(171) and profuse (81) branching habit. Ramachandran *et al.*, (1972); Shadakshari *et al.*, (1985) and Valarmathi *et al.*, (2003) reported similar findings.

Hairiness is a trait of sesame which we have observed in various parts of plant like stem, leaves, corolla, capsule (Weiss, 1983). This trait provides resistance, tolerance to different biotic and abiotic stresses. Fray *et al*. (2015); Ozcinar, (2017) and Singh *et al.*, (2017) also elucidate this trait during their studies on characterization of sesame genotypes.

In the study for the trait of stem hairiness, was observed maximum dense hairiness (371) followed by absence (86) and sparse (43) in sesame accessions. Leaf hairiness helps in protecting the leaves from sunlight and it may be related to biotic and abiotic stress (Bedigian, 2004) and further classified as glabrous (164), sparse (292) and medium (44) hairiness. Corolla hairiness is a good protective measure for the loss of moisture content in the flower at mounting temperatures and it shows effect on the flower pollination (Ozcinar, 2017). In the trait corolla hairiness, 363 accessions were dense and 137 accessions were having sparse corolla hairiness.

In the trait of capsule hairiness (Fig. 1), maximum accessions were observed as having sparse (237), to be followed by strong (154 accessions), medium (81 accessions) and 28 accessions were observed as glabrous which means hairiness absent on capsule. Capsule hairiness is considered as an important trait for protecting capsule from some biotic and abiotic stresses (Fray *et al*., 2015). Singh *et al*. (2017) also observed same trait in their experiments on sesame. Trichomes or hairiness are related to natural defense mechanism for different biotic, abiotic stress and they are rich in defense related proteins (Amme *et al.*, 2005).

In case of stem color, most of the accessions (453) were observed as green color and 47 accessions were purplish green in colour. In leaf shape trait, observations were recorded from middle and top leaves separately (Fig. 2). In middle leaves most of the accessions were ovate (447) in shape followed by elliptic (53). In top leaves maximum accessions were observed as lanceolate (362) and 138 were linear in shape.

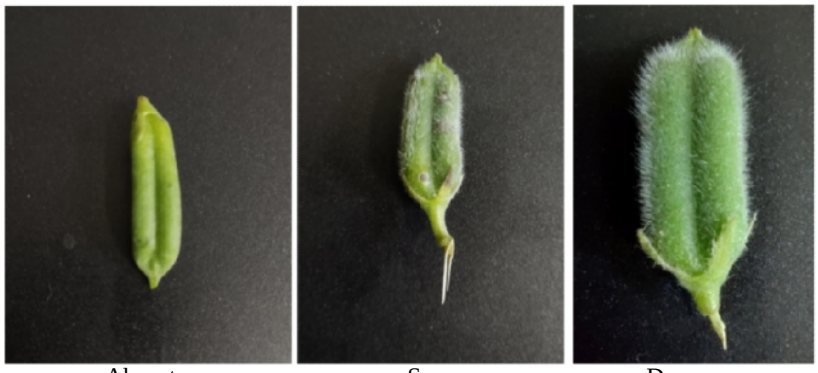


Fig. 1. Capsule hairiness.

Fig. 2. Leaf Shape.

Most of the accessions were observed to be having serrate type basal leaf margin (383) followed by entire(104) and denate (13)(Fig. 3). Observable variation present in the trait of lobe incision of basal leaf (Fig. 4) was recorded *i.e.*, medium(256), strong(155), weak(69) and absent(20). Similar findings were recorded by Jadhav *et al.*, (2015). 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 accessions. Panwar & Bisen (2020) and Singh *et al*. (2017) also used this trait as one of the criteria for characterization of genotypes in sesame.

In trait of petiole colour, maximum accessions were observed to be greenish purple in colour (472) and green(28) colour.

In the trait corolla colour (Fig. 5), maximum accessions were observed to have white with pink shading (409) and few white with deep pink shading (91). The trait no. of flowers per leaf axil (Fig. 6) had less variation and almost all the accessions were one flower per leaf axil (492) except eight accessions were having more than one flowers per leaf axil.

In case of capsule shape (Fig. 7), most of the accessions were narrow Oblong (476) followed by Broad oblong (24). According to singh *et al.*, (2017), plants which are having four locules per capsules are selected by the breeders because of fertile seeds. In the trait, Number of locules per capsule, maximum accessions were observed to have four (492) and only some accessions observed six (5) and eight (3) locules. In capsule arrangement (Fig. 8) maximum accessions were monocapsular (492) and only 8 accessions were multi capsular. Short capsule beak is a trait which may lead to non/low shattering which helps in increase in the yield and farmer's preference (Singh *et al.*, (2017) and Suhasini (2006)). In type of capsule beak, most of the accessions were short (231) followed by long(156) and curved(113).

Entire Serrate

Fig. 3. Basal leaf margin.

Absent (Leaf Entire) Weak Medium Strong

Fig. 4. Lobe incision of basal leaf.

One More than One White with pink shading white with deep pink shading

Fig. 5. Number of flower per Leaf Axil.

Fig. 6. Corolla Colour.

Narrow Oblong

Broad Oblong

Fig.7. Bicarpellate Capsule shape.

Mono Capsular

Multi Capsular

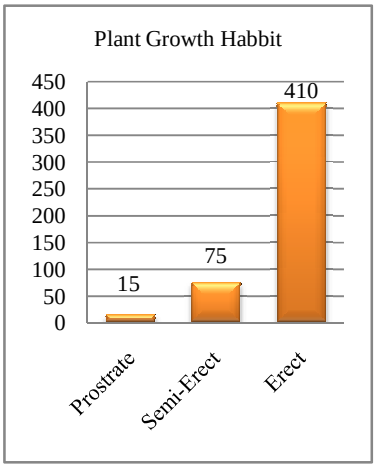
Fig. 8. Capsule Arrangement.

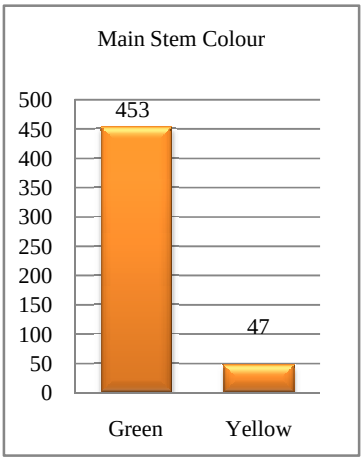
Colour of capsule mostly depend on the climatic factors *viz.,* moisture content in air, moisture content in soil and development of capsule (Panwar & Bisen (2020). Capsule colour is a good index to identify the mature accessions. It is good to harvest when 80 percent of capsule exhibit yellowing and leaves are dropping off (Langham *et al.,* 2007). Out of 500 accessions, maximum accessions have colour of dry capsule are brown in colour (359) followed by yellow colour (141) is presented in Table 1 and graphical representation of morphological traits presented in Fig. 9.

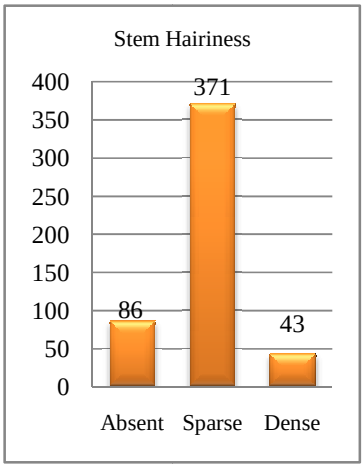
Table 1: Frequency distribution and percent score of morphological traits.

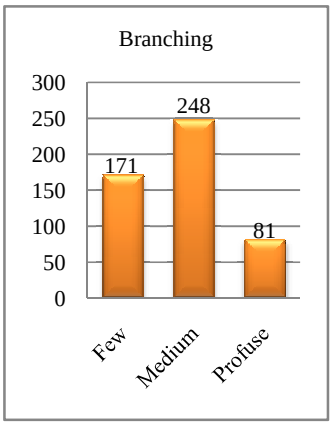
Trait	Class	Score	Accessions	Frequency
Plant Growth Habbit	Prostrate	1	15	3
	Semi-Erect	2	75	15
	Erect	3	410	82
Main Stem Colour	Green	1	453	90.6
	Yellow	2	47	9.4
Stem Hairiness	Absent	1	86	17.2
	Sparse	3	371	74.2
	Dense	5	43	8.6
Branching	Few	3	171	34.2
	Medium	5	248	49.6
	Profuse	7	81	16.2
Branching pattern	Basal branching	1	42	8.4
	Top branching	2	458	91.6
Leaf hairiness	Glabrous(Absent)	0	164	32.8
	Weak or Sparse	3	292	58.4
	Medium	5	44	8.8
	Strong / Profuse	7	0	0
Leaf Shape	Top : Linear	1	138	27.6
	Lanceolate	2	362	72.4
	Medium : Elliptic	3	53	10.6
	Ovate	4	447	89.4
Basal Leaf Margin	Entire	1	104	20.8
	Serrate	2	383	76.6
	Denate	3	13	2.6
Lobe Incision of basal leaf	Absent (Leaf entire)	0	20	4
	Weak	3	69	13.8
	Medium	5	256	51.2
	Strong	7	155	31
Petiole colour	Green	1	28	5.6
	Greenish Purple	2	472	94.4
No. of Flower per Leaf axil	One	1	492	98.4
	More than one	2	8	1.6
Corolla hairiness	Absent	1	0	0
	Sparse	3	137	27.4
	Dense	5	363	72.6
Corolla colour	White with pink shading	2	409	81.8
	White with deep pink shading	3	91	18.2
No.of locules per capsules	Four	1	492	98.4
	Six	2	5	1
	Eight	3	3	0.6

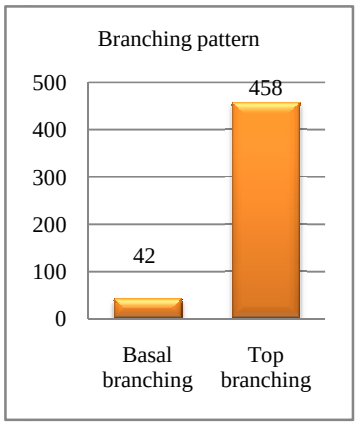
Bicarpellate capsule shape	Narrow oblong	2	476	95.2
	Broad oblong	3	24	4.8
Capsule arrangement	Monocapsular	1	492	98.4
	Multicapsular	2	8	1.6
Capsule hairiness	Glabrous (Hair absent)	0	28	5.6
	Weak or sparse	3	237	47.4
	Medium	5	0	0
	Strong or Profuse	7	154	30.8
Colour of dry capsule	Straw/yellow	2	141	28.2
	Brown/tan	3	359	71.8
Type of capsule beak	Short	1	231	46.2
	Long	2	156	31.2
	Curved	3	113	22.6

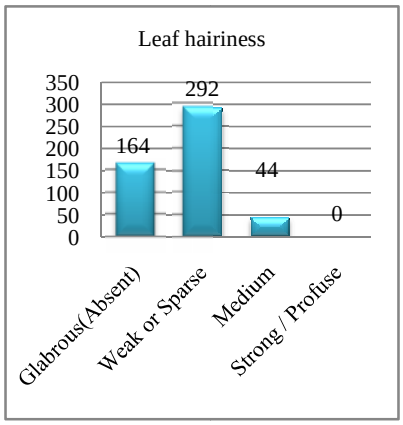


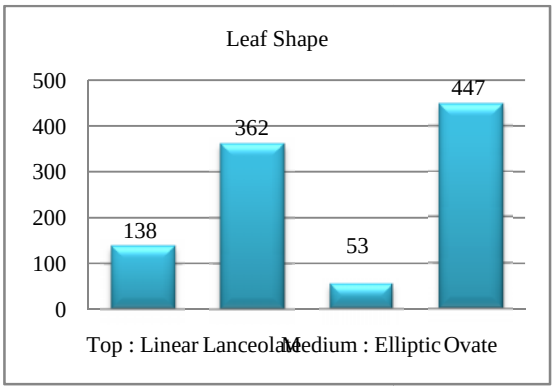


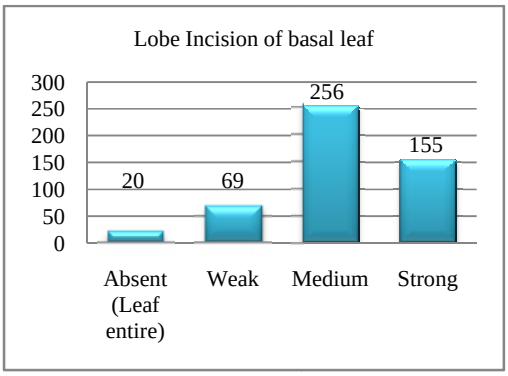












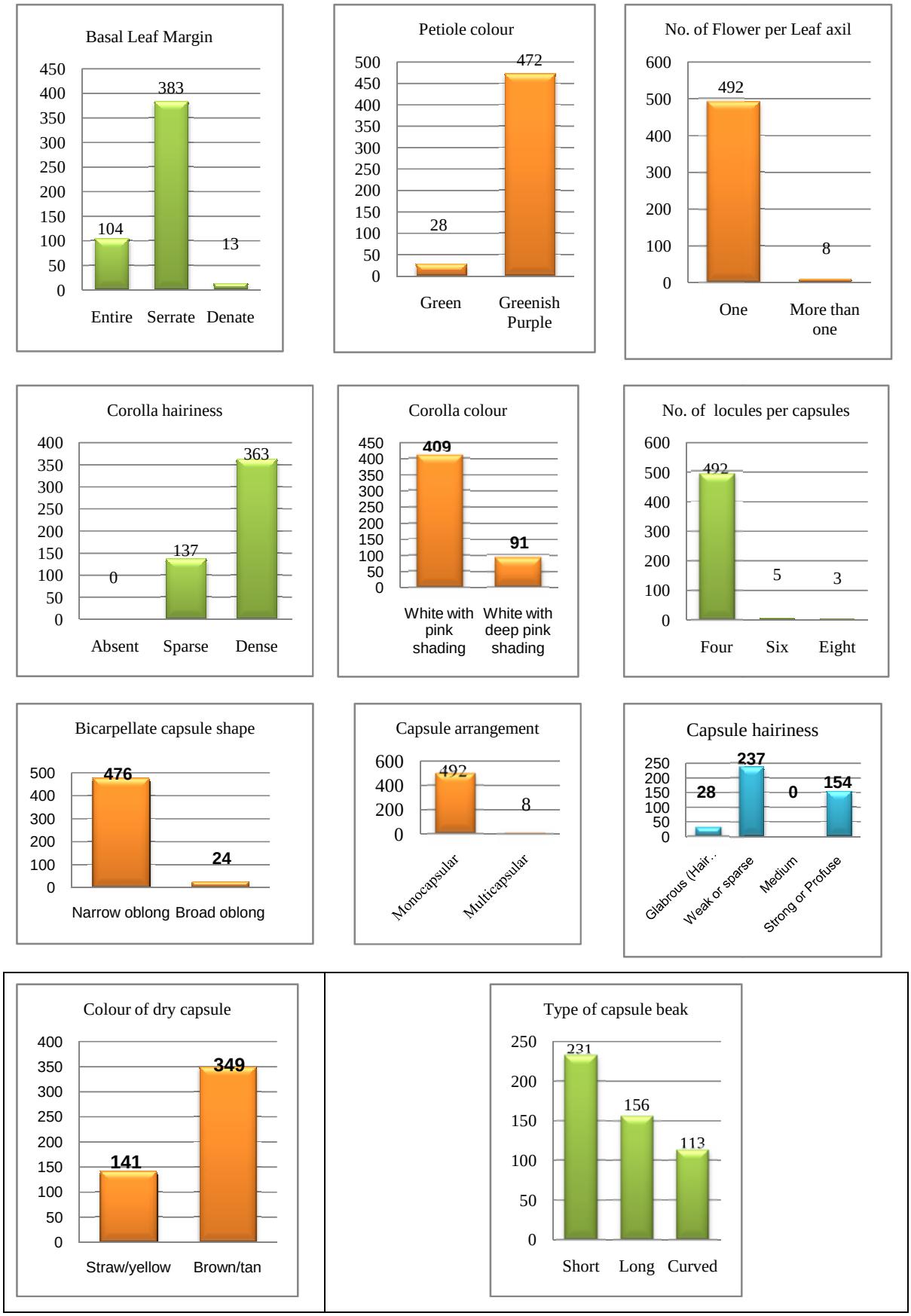


Fig. 9. Characterization of morphological traits based on NBPGR guidelines.

CONCLUSION

A huge variation is available in 500 accessions for different qualitative traits. In our experiment maximum accessions acquired erect plant growth habit and top branching with medium branches with top leaves Lanceolate and ovate middle leaves in shape. serrate Basal leaf margin and medium in basal leaf lobe incision, with respect to trait of colour, maximum accessions were green in stem colour, greenish purple in petiole colour, white with pink shading in corolla colour, brown in dry capsule colour. Hairiness exhibited in different parts of plants *i.e.* sparse stem hairiness, weak leaf hairiness, dense corolla hairiness, sparse capsule hairiness. Most of the accessions exhibited to be four loculed with narrow oblong in bicarpellate capsule shape and one flower per leaf axil. Maximum accessions exhibited short capsule beak and monocapsular in capsule arrangement. This experiment revealed discrete traits of accessions and indicated that Diversity exist in collected accessions because of variation in genetic architecture however, need to do supplementary study on other traits which are not studied at genetic level. This study will be helpful to breeders, farmers and other researchers to identify the desired accessions and conservation of favourable genes for crop improvement.

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Conflict of interest. Nil

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