Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue [1] 2017: 05-12

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804
NAAS Rating 4.95

FULL LENGTH ARTICLE **OPEN ACCESS**

DUS Testing of Sesame *(Sesamum indicum L.)* varieties using Morphological Descriptors

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ABSTRACT
The aim of the present study is to characterize 83 varieties of sesame (Sesamum indicum L.) based on the DUS descriptors. The experiment was conducted in Randomized Complete Block Design with three replications at Project Coordinating Unit (Sesame and Niger) Research Farm, JNKVV, Jabalpur (M.P.) during kharif 2016. On the basis of DUS descriptors, sesame varieties were characterized for eighteen morphological traits. A significant amount of variation was observed for most of the traits studied. The results revealed that maximum variation was recorded in seed coat colour, capsule shape, leaf lobe, leaf size, leaf serration, capsule hairiness, capsule arrangement, stem hairiness, petal colour, seed size, days to 50% flowering, branching pattern and petal hairiness. On the basis of frequency distribution, a majority of sesame varieties were found to possess early duration of 50% flowering with light purple petal colour, sparse petal hairiness, basal branching pattern, medium plant height, medium plant branching, sparse stem hairiness, medium leaf size, slightly lobed leaf, strong leaf serration, sparse capsule hairiness, broad oblong capsule shape, alternate capsule arrangement, medium capsule length,early maturity and white seed coat colour. Above study revealed the distinct characteristics of sesame varieties and indicated that morphological variations exist in these lines due to variation in genetic makeup and could be better utilized by breeders in the selection based on their specific requirement for breeding programme. This is highly useful study for varietal identification and conservation.
Key words: *DUS testing, Morphological variation, Varieties, Sesame*

Received 23.07.2017 Revised 12.08.2017 Accepted 29.08. 2017

INTRODUCTION

Sesame (*Sesamum indicum* L.) thought to have originated in Africa, is considered to be the oldest oilseed crop known to man and is now grown in many parts of the world including the U.S. Sesame seed is an important source of edible oil and is also widely used as a spice. The seed contains 50-60% oil which has excellent stability due to the presence of natural antioxidants such as sesamolin, sesamin and sesamol [1]. The fatty acid composition of sesame oil varies considerably among the different cultivars worldwide [2]. After oil extraction, the remaining meal contains 35-50% protein, and is rich in tryptophan and methionine. Seeds with hulls are rich in calcium (1.3%) and provide a valuable source of minerals [3].

In order to introduce a new plant variety to the markets commercially, it is necessary to register newly bred variety, which relies upon the results of DUS (distinctness, uniformity, and stability)tests; that is, for a new genotype to be registered as a commercial variety, it needs to be distinct (D)from all other released varieties, uniform (U) and stable (S) for morphological and other evaluated traits [4, 5]. Therefore, DUS test has been established to be the foundation of plant variety protection and also to identify a new variety from reference collection [6].

The current system of DUS testing has come across several significant shortcomings. The varieties to be assessed are increasing in number where their variability reduces, and the reference collections are expanding because of their internationalization, both of which result in the dramatic increase in expenses associated with these methods. Moreover, the existing methods are time consuming, which have altogether led to more necessity for developing a substitutionary, less costly system. Thus, the studies on the use of molecular markers in DUS testing proving the expected capability of molecular markers have encouraged International Union for the Protection of New Varieties of Plants (UPOV) to contemplate the introduction of molecular markers to the DUS testing system. Nevertheless, before this decision could be

made, there are several issues to be resolved. Ideotype breeding aimed at modifying the plant architecture is also time-tested strategy to increase the yield potential.
Therefore, the present study was undertaken to characterize the released varieties of sesame using DUS descriptors.

MATERIALS AND METHODS

Eighty three varieties of sesame were grown in a randomized complete block design replicated thrice at Project Coordinating Unit (Sesame and Niger) Research Farm, JNKVV, Jabalpur (M.P.) during two seasons *kharif* and Summer(2015-16).The distance between rows was maintained at 0.40 m and plant to plant 0.15 m. The crop was raised under recommended package of practices alongwith prophylactic protection measures. The observations were recorded on 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.
DUS Testing: Eighteen morphological descriptors have been considered essential for the description of eighty-three varieties of sesame using guidelines for the conducting test for distinctiveness, uniformity and stability in sesame.

RESULTS AND DISCUSSION

Morphological traits of the sesame varieties were studied using DUS descriptors. Result revealed that a significant amount of variation was recorded on almost all the characters recorded. The sesame varieties may be grouped as alternate, opposite and cluster type capsule arrangement; sparse, dense and glabourous type capsule hairiness; broad oblong, narrow oblong, tapered and square type capsule shape; sparse, dense and glaborous stem hairiness.The traits, mixed leaf position, profuse capsule hair density, broad oblong capsule shape and sparse stem hairiness are dominant over opposite leaf position, sparse capsule hair density, narrow oblong capsule shape and glabrous stem hairiness, respectively. Hairiness is the important character for providing more seed yield and natural defense mechanism for some biotic and abiotic factors. Therefore, this character could be assessed as a part of ideal plant type.
The trait days to 50% flowering varied significantly among the genotypes. The genotypes were grouped into 3 categories as early (58)(DSS-9,TILOOTTAMA), medium (21)(RAJESHWARI,TG-308, RT-54) and late (4)(PHULE TIL-1, PKDS-11).The petal colour of the flower is one of the important characters for characterization. Based on the variation in the flower petal colour, the genotypes were grouped into three categories namely white (3 genotypes) (VRI-1,KALIKA,UMA), light purple (70genotypes) (SVPR-1,TKG-306,TILOTTAMA) and dark purple (10 genotypes) (PURVA-1,PKDS-11) types. The genes determine the colour of the petal by developing or blocking of anthocyanin pigmentation.The genotypes varied among themselves for petal hairiness. Among 83 genotypes, 21 were dense(VRI-2,AKT-64) and 62 were sparse(JLT-26,RAMA). Based on plant height, varieties are categorized under short (29)(PUNJAB TIL-1,SAVITRI), medium (54) (KRISHNA,BRIJESHWARI) and tall(DSS-9). Alege and Mustapha [7] reported that plant height is not under strong genetic influence. In the present study, basal (60)(RAMA,THILATHARA) and Top branching (13)(THILOTHAMA,PTATAP) patterns were observed. In previous studies, it was indicated that the inheritance of branching habit was determined by one single dominant gene [11]. However, the genetic basis of them has remained elusive.
Among the 83 genotypes, 2 genotypes(YLM-17) showed dense stem hairiness, 60 genotypes(SOMA,KRISHNA) had sparse hairiness and 21 genotypes(VRI-2,JLT-26)were categorized under the category of absent stem hairiness. Leaf size varied significantly among the genotypes. In case of leaf size 27 had small, 43 were having medium and 13 had large leaf size. On the basis of leaf lobes, genotypes were categorized as slightly lobed (63)(PRAGATI,SEKHAR) and deeply lobed (18)(KANAK,KALIKA). Among 83 genotypes, 56 had strong serration, 20 had weak and 7 had entire type leaf serration. On the basis of capsule hairiness genotypes were categorized as dense (19)(GT-2,JTS-8), sparse (61)(GT-3,GT-10) and absent (3)(PURVA-1). Based on locule number per capsule, 81 varieties (RT-46, PKDS-11) are categorized into four locular and two were six locular.On the basis of capsule number per leaf axil, 81genotypes(RT-46,CHANDANA) are categorized as one capsule per leaf axil and 2 genotypes(VRI-2,KRISHNA) as more than one capsule per leaf axil. Among the 83 genotypes, 53(CO-1, SVPR-1) were broad oblong, 27 (PRAGATI, KANAK) narrow oblong, 3(TMV-3,VRI-1) tapered and none of the genotypes had square shaped capsules. On the basis of capsule arrangement, 70 varieties (SOMA, VRI-2) had alternate, 11(HIMA, SWETHA TILL) had opposite and only 2 variety (JLT-26) had cluster type capsule arrangement. Among 83 varieties 19(GT-10, PRATAP) were short capsule, 33(CO-1, SVPR-1) were medium and 31(GUJRAT TIL-1, PKDS-11) were long capsule. On the basis of days to maturity, 42(JLT-408) were early, 25(JLT-26, HT-1) were medium duration, 13(SOMA, VRI-2) were late duration

and 5 were very late matured variety. In case of seed coat colour, 47(SOMA, BRIJESHWARI) were white seeded, 21(VRI-2, RAMA) had dark brown, 11(SAVITRI, YLM-17) had light brown and 4(GT-10, KRISHNA) had black seed coat colour.

A wide range of variation, i.e. white, grey, light brown, dark brown and black was observed for seed coat colour against the reported white, brown and black. All earlier researchers in sesame, outlined seed coat colour to be under digenic control with several confusing segregants beyond plausible explanation [8, 9]. Recently, Zhang *et al.* [10], using a high-density linkage map analyzed the genetic segregation and quantitative trait loci (QTL) for sesame seed coat color and showed that two major genes with additive-dominant-epistatic effects along with polygenes were responsible for controlling the seed coat color trait. The highest polymorphism was observed for seed coat color ranging from white to black through all intermediate colors.

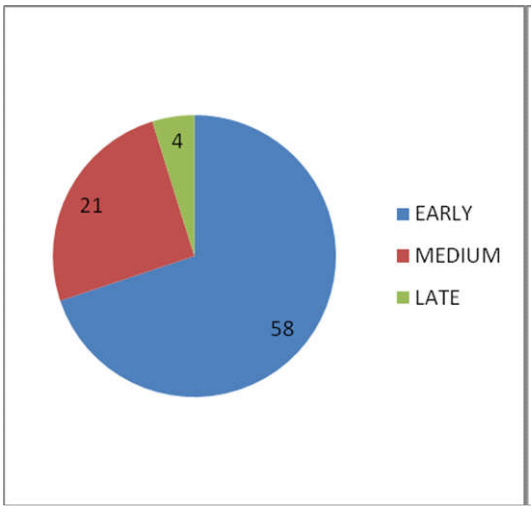
Frequency distribution for 18 morphological traits is depicted in Table 1 and its graphical representation of frequency distribution is showed in Figure 1. A majority of sesame varieties were found to possess early duration of 50% flowering (69.87%), light purple petal colour (84.33%), sparse petal hairiness (74.69%), basal branching pattern (72.28%), medium plant height (65.03%), medium plant branching (51.80%), sparse stem hairiness (72.28%), medium leaf size (51.80%), slightly lobed leaf (75.90%), strong leaf serration (67.46%), sparse capsule hairiness (71.0%), four locule per capsule (97.59%), broad oblong capsule shape (63.85%), one capsule per leaf axil (98.79%), alternate capsule arrangement (84.33%), medium capsule length (39.75%), early days to maturity (50.60%) and white seed coat colour (56.62%).

Above study revealed the distinct characteristics of sesame varieties and indicated that morphological variations exist in these lines due to variation in genetic makeup and could be better utilized by breeders in the selection based on their specific requirement for breeding programme as this is highly useful study for varietal identification and conservation.

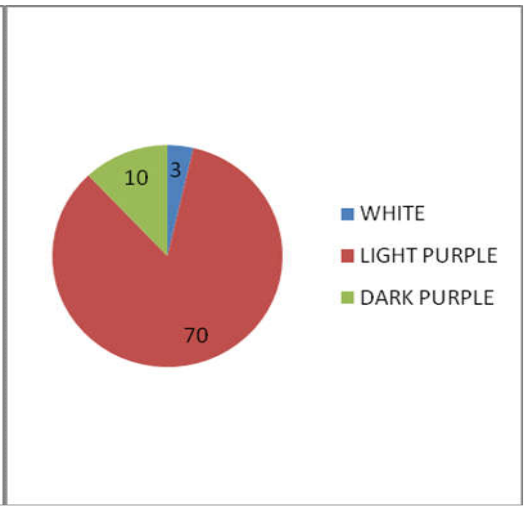
Table No-1: Categorization of Sesame Varieties

SN	Character	Number of entries/ frequency	Percentage of entry (%)
1	**50% FLOWERING**		
	EARLY	58	69.87
	MEDIUM	21	25.30
	LATE	4	4.81
2	**PETAL COLOR**		
	WHITE	3	3.60
	LIGHT PURPLE	70	84.33
	DARK PURPLE	10	12.04
3	**PETAL HAIRINESS**		
	DENSE	21	25.30
	SPARSE	62	74.69
4	**PLANT HEIGHT**		
	SHORT	29	34.93
	MEDIUM	54	65.03
	TALL	0	0.00
5	**PLANT BRANCHING**		
	ABSENT	0	0.00
	FEW	4	0.05
	MEDIUM	43	51.8
	PROFUSE	36	43.33
6	**BRANCHING PATTERN**		
	BASAL	60	72.28
	TOP	13	15.66
7	**STEM HAIRINESS**		
	ABSENT	21	25.30
	SPARSE	60	72.28
	DENSE	2	2.40
8	**LEAF LOBE**		
	SLIGHTY LOBED	63	75.90
	DEEPLY LOBED	18	21.68
9	**LEAF SIZE**		
	SMALL	27	32.53
	MEDIUM	43	51.80

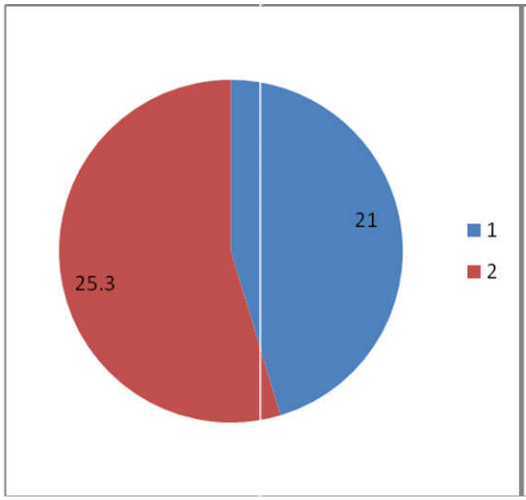
	LARGE	13	15.66
10	**LEAF SERRATION**		
	WEAK	20	24.00
	STRONG	56	67.46
	ENTIRE	7	8.40
11	**CAPSULE HAIRINESS**		
	ABSENT	3	3.60
	SPARSE	61	71.0
	DENSE	19	25.30
12	**LOCULE NUMBER/CAPSULE**		
	FOUR	81	97.59
	SIX	2	2.40
	EIGHT	0	0.0
13	**CAPSULE SHAPE**		
	TAPERED	3	3.60
	NARROW OBLONG	27	32.53
	BOARD OBLONG	53	63.85
	SQUARE	0	0
14	**CAPSULE NUMBER PER LEAF AXIL**		
	One	82	98.79
	More than one	1	1.20
15	**CAPSULE ARRANGEMENT**		
	ALTERNATE	70	84.33
	OPPOSITE	11	13.2
	CLUSTER	2	2.40
16	**CAPSULE LENGTH**		
	SHORT	19	22.89
	MEDIUM	33	39.75
	LONG	31	37.34
17	**DAYS TO MATURITY**		
	EARLY	42	50.60
	MEDIUM	25	27.71
	LATE	13	15.66
	VERY LATE	3	6.02
18	**SEED COAT COLOUR**		
	WHITE	47	56.62
	LIGHT BROWN	11	13.25
	DARK BROWN	21	25.30
	BLACK	4	4.81



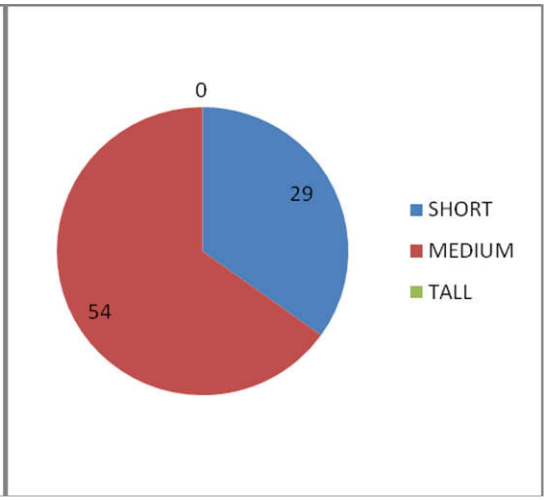
Days to 50% flowering



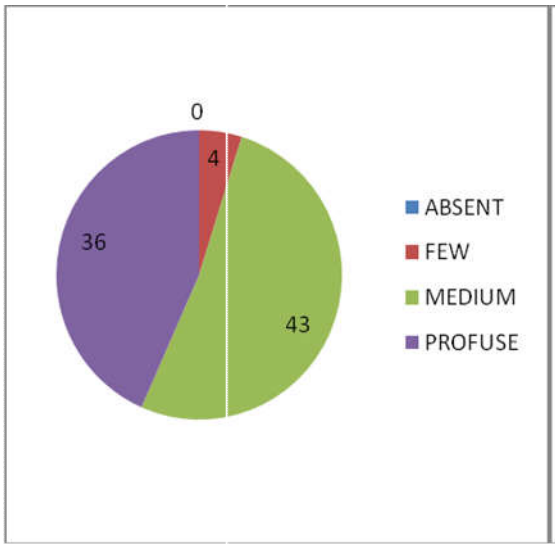
Petal colour



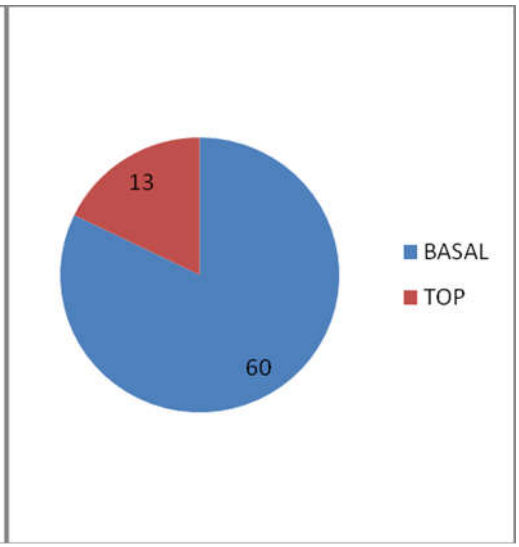
Petal hairiness



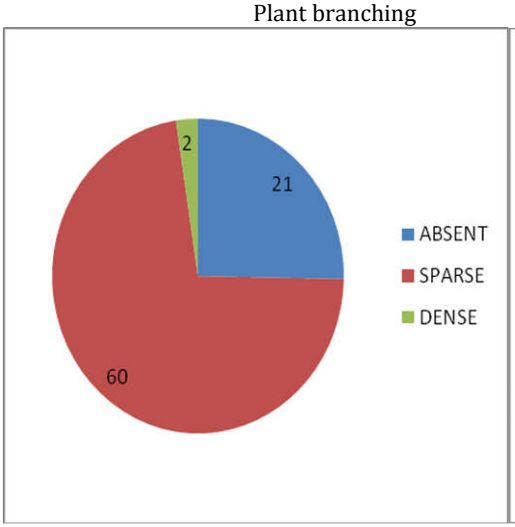
Plant height



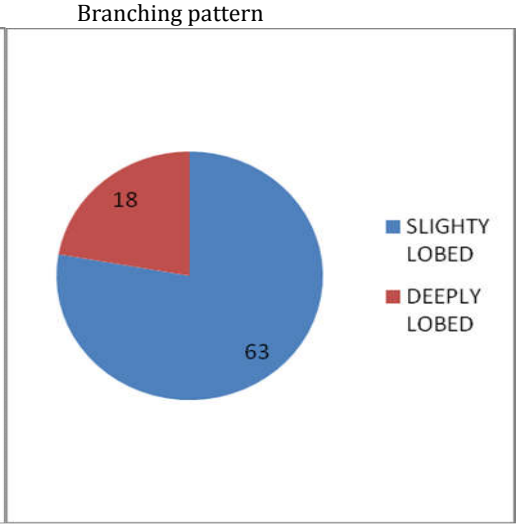
Plant branching



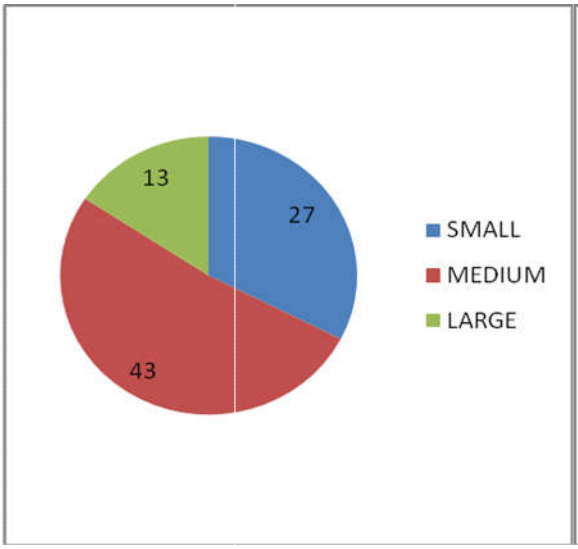
Branching pattern



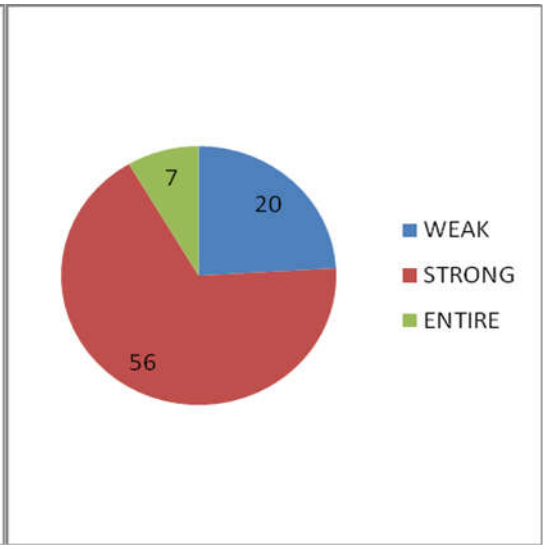
Stem hairiness



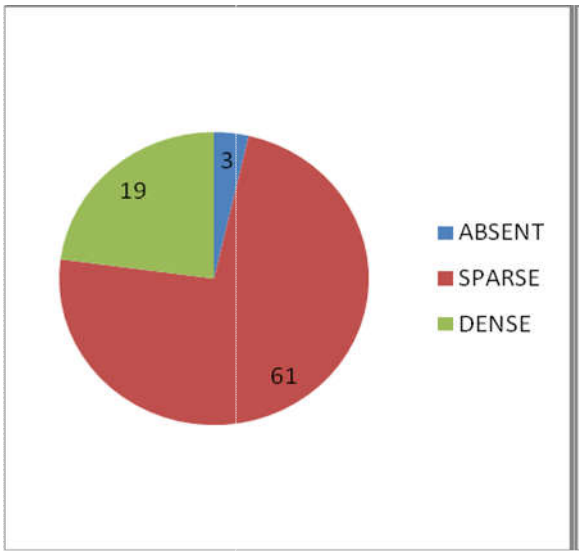
Leaf lobe



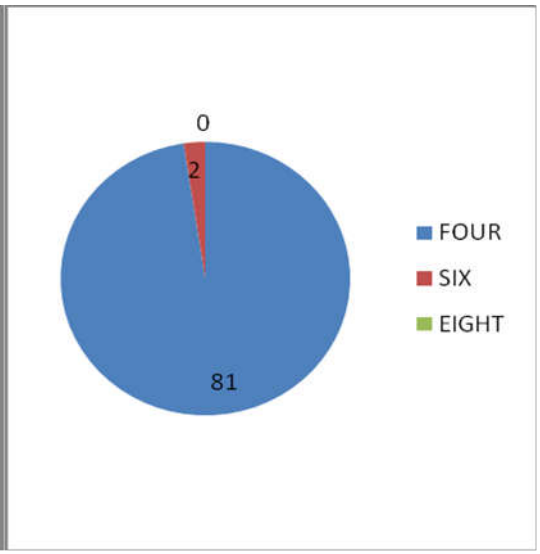
Leaf size



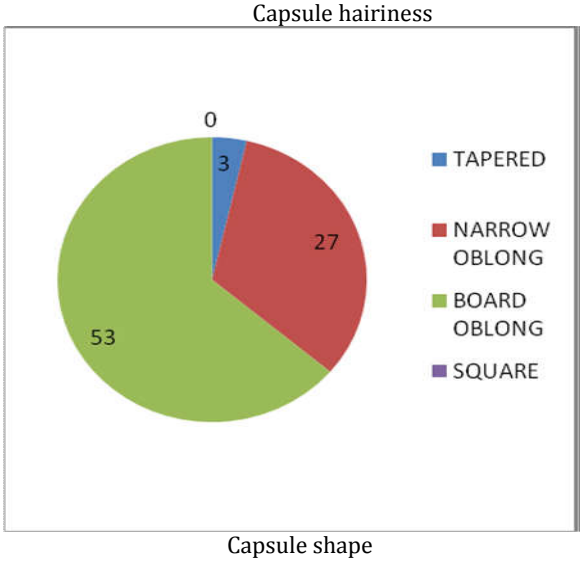
Leaf serration



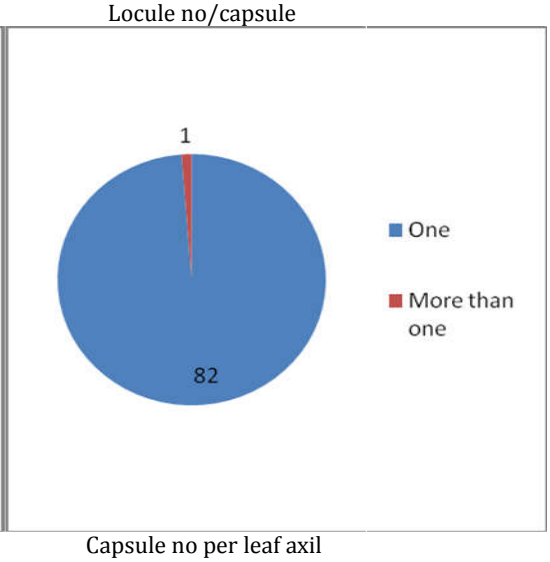
Capsule hairiness



Locule no/capsule



Capsule shape



Capsule no per leaf axil

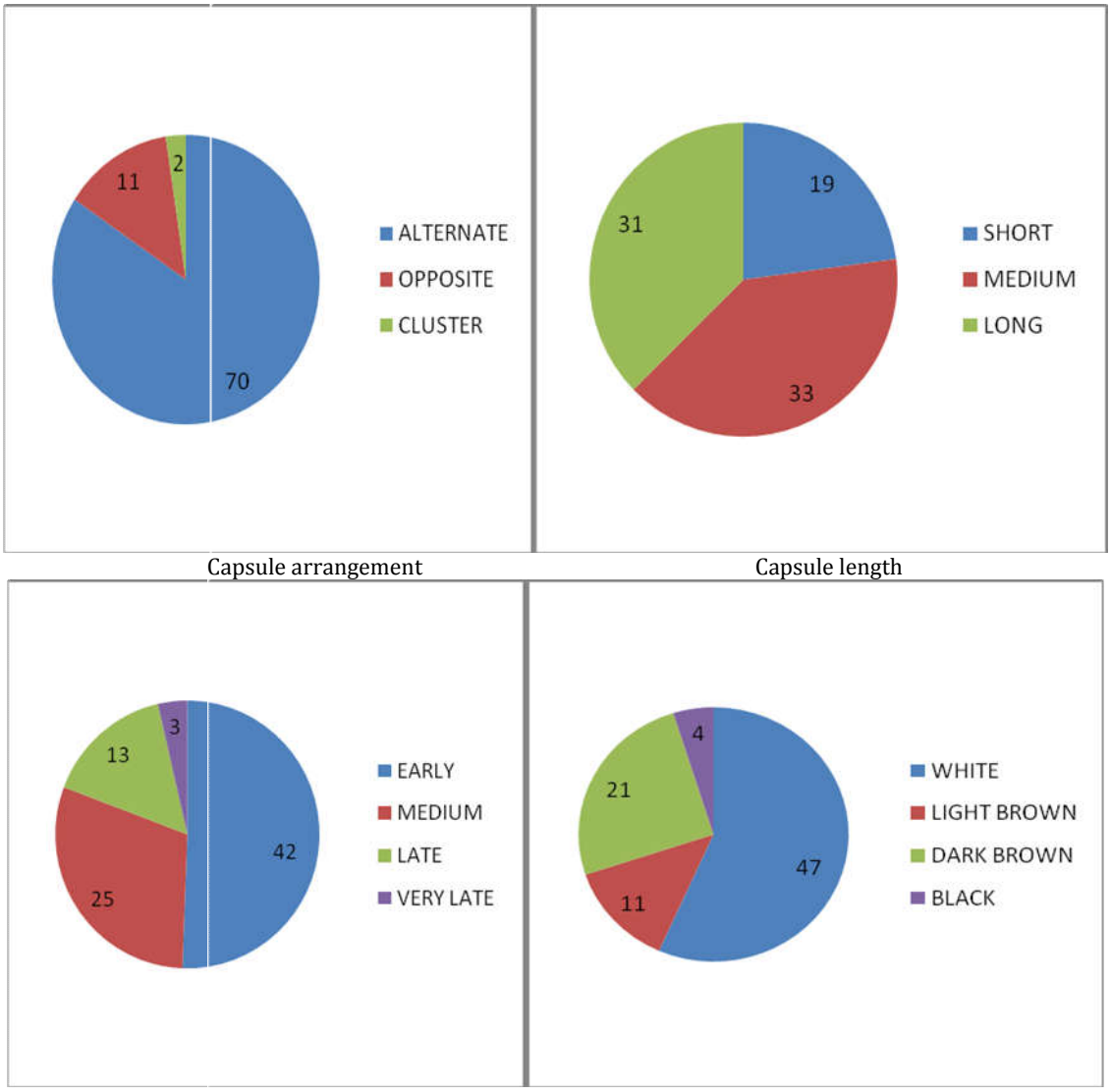


Fig. 1: Frequency distribution of different morphological traits in sesame

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CITATION OF THIS ARTICLE

Bhagwat Singh, Rajani Bisen and Akanksha Tiwari . DUS Testing of Sesame *(Sesamum indicum L.)* varieties using Morphological Descriptors. Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue 1, 2017: 05-12