

Characterization of Black Sesame (*Sesamum indicum* L.) Genotypes through Capsule Morphology

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ABSTRACT: An experiment was carried out at the Sagdividi Farm, Department of Seed Science and Technology, Junagadh Agricultural University, Junagadh, to characterize forty black sesame genotypes based on the morphological characters of the capsule. The genotypes were grouped based on the capsule hairiness into three groups namely absent (3 genotypes), sparse (30 genotypes) and dense (7 genotypes). Based on the number of locules per capsule two groups were made i.e., four locules per capsule in (37 genotypes) and six locules per capsule in (3 genotypes). Based on the capsule shape, genotypes were grouped into tapered (13 genotype), narrow oblong (9 genotypes) and broad oblong (18 genotypes) types. Based on the number of capsules per leaf axil, genotypes were grouped into one (36 genotypes) and more than one (4 genotypes) capsules per leaf axil. Based on capsule arrangement, genotypes were grouped into alternate (13 genotypes), opposite (25 genotypes) and cluster (2 genotypes) types. Based on variation in number of capsules per plant, genotypes were grouped into two categories as, moderate (33 genotypes) and less (7 genotypes). Based on variation in capsule length, genotypes were grouped into two categories as medium (30 genotypes) and long (10 genotypes). Based on the beak of capsule, genotypes were grouped as, short (14 genotypes) and long (26 genotypes) beaked types.

Keywords: Black sesame, characterization, capsule morphology

INTRODUCTION

Sesame (*Sesamum indicum* L., $2n = 26$) is an ancient oilseed crop grown widely, next only to groundnut and mustard in India. Sesame is called the “Queen of oilseeds” because of the excellent qualities of the seed, oil and meal. Generally, the oil content in sesame ranges from 34 to 63 per cent [1]. Genetic and environmental factors influence the oil content and fatty acid compositions in sesame [2]. Late maturing cultivars are reported to have higher oil content than early maturing cultivars [3], while the indeterminate cultivars accumulate more oil than determinate ones [4]. Sesame seed is highly nutritive (oil 50%, protein 25%) and its oil is an excellent vegetable oil because of its high contents of antioxidants such as sesamin, sesamol and sesamolins and its unsaturated fatty acid composition [5]. Seeds are rich source of linoleic acid, vitamin E, A, B1 and B2; minerals including Ca and P. After oil extraction, the remaining meal contains 35-50% protein, and is rich in tryptophan and methionine. Seed coats are rich in calcium (1.3%) and provide a valuable source of minerals [6].

The purpose of this study was to characterize the variability in capsule morphological traits that would allow

identification of potential parents for future sesame breeding programmes, as well as for field inspection in Certified Seed production.

MATERIALS AND METHODS

A field experiment was conducted at the Sagdividi Farm, Department of Seed Science and Technology, Junagadh Agricultural University, Junagadh, during *Summer* 2020 to characterize 40 black sesame genotypes viz., IC 43063, Malvan 1, Vinimik 81, TNAU 12, RJS 190, Jira 24, Bhuva 2, Khadkala 1, Khadkala 5, Khadkala 7, Nana bhamodara 5, Hathigadh 1-3, Mota Liliya 2, Lalavadar 6, Ansodar 3, Lathi 3, Keriya 5, Keriya 6, Keriya 8, Keriya 11, Liliya 1, Nana Rajkot 1, IC 96127, IC 322186, IC 132281, IC 204653, IC 204666, IC 204681, IC 204983, IC 204496, IC 199435-E, IC 204526, IC 204528, IC 127278, IC 199433, NIC 8486, NIC 17326, KR 77, NIC 17336 and NIC 17598 based on capsule morphological characters. They were sown at 45 cm × 10 cm distance in a randomized block design with three replications. All the recommended cultural practices were carried out during crop growth. The observations were recorded on five randomly picked plants. Analysis of variance for

Randomized Block Design was computed as per the method of [7].

RESULTS AND DISCUSSION

The capsule morphological characteristics are important as these influence the yielding ability of the plant. The genotypic variation was observed for various characteristics of capsules such as hairiness, number of locules per capsule, capsule shape, number of capsules

per leaf axil, capsule arrangement, number of capsules per plant, capsule length and beak of capsule, which helped in classifying the genotypes into different groups (Table 1, 2 and 3, Figure 1).

The genotypes were grouped into three groups based on the capsule hairiness namely absent (3 genotypes), sparse (30 genotypes) and dense (7 genotypes) hairy types. Based on the number of locules per capsule

Table 1. Identification and grouping of black sesame genotypes based on capsule hairiness, number of locules per capsule and capsule shape

Genotypes	Capsule hairiness	Number of locules per capsule	Capsule shape
IC 43063	Sparse	Four	Tapered
Malvan 1	Sparse	Four	Narrow oblong
Vinimik 81	Sparse	Four	Tapered
TNAU 12	Absent	Six	Broad oblong
RJS 190	Sparse	Four	Narrow oblong
Jira 24	Dense	Four	Broad oblong
Bhuva 2	Sparse	Four	Broad oblong
Khadkala 1	Absent	Four	Narrow oblong
Khadkala 5	Sparse	Six	Broad oblong
Khadkala 7	Dense	Four	Tapered
Nana bhamodara 5	Sparse	Four	Broad oblong
Hathigadh 1-3	Sparse	Four	Broad oblong
Mota Liliya 2	Sparse	Four	Broad oblong
Lalavadar 6	Dense	Six	Broad oblong
Ansodar 3	Sparse	Four	Narrow oblong
Lathi 3	Sparse	Four	Tapered
Keriya 5	Sparse	Four	Narrow oblong
Keriya 6	Sparse	Four	Broad oblong
Keriya 8	Sparse	Four	Tapered
Keriya 11	Sparse	Four	Broad oblong
Liliya 1	Sparse	Four	Broad oblong
Nana Rajkot 1	Sparse	Four	Narrow oblong
IC 96127	Sparse	Four	Narrow oblong
IC 322186	Dense	Four	Tapered
IC 132281	Sparse	Four	Tapered
IC 204653	Sparse	Four	Broad oblong
IC 204666	Dense	Four	Broad oblong
IC 204681	Dense	Four	Broad oblong
IC 204983	Sparse	Four	Narrow oblong
IC 204496	Absent	Four	Tapered
IC 199435-E	Sparse	Four	Tapered
IC 204526	Sparse	Four	Tapered
IC 204528	Dense	Four	Broad oblong
IC 127278	Sparse	Four	Broad oblong
IC 199433	Sparse	Four	Tapered
NIC 8486	Sparse	Four	Broad oblong
NIC 17326	Sparse	Four	Narrow oblong
KR 77	Sparse	Four	Broad oblong
NIC 17336	Sparse	Four	Tapered
NIC 17598	Sparse	Four	Tapered

Table 2. Identification and grouping of black sesame genotypes based on capsule length (cm) and days to maturity

Genotypes	Capsule length (cm)	Group	Days to maturity	Group
IC 43063	1.82	Medium	102.00	Very late
Malvan 1	2.16	Medium	104.00	Very late
Vinimik 81	2.15	Medium	101.00	Very late
TNAU 12	2.67	Long	94.67	Late
RJS 190	2.39	Medium	98.67	Very late
Jira 24	2.33	Medium	105.00	Very late
Bhuva 2	2.75	Long	101.00	Very late
Khadkala 1	2.35	Medium	93.67	Late
Khadkala 5	2.90	Long	114.33	Very late
Khadkala 7	2.23	Medium	105.00	Very late
Nana bhamodara 5	1.77	Medium	109.00	Very late
Hathigadh 1-3	2.41	Medium	109.00	Very late
Mota Liliya 2	2.80	Long	108.33	Very late
Lalavadar 6	2.35	Medium	104.67	Very late
Ansodar 3	2.34	Medium	107.67	Very late
Lathi 3	2.11	Medium	110.00	Very late
Keriya 5	2.26	Medium	94.33	Late
Keriya 6	1.95	Medium	93.67	Late
Keriya 8	2.26	Medium	106.33	Very late
Keriya 11	2.23	Medium	100.33	Very late
Liliya 1	2.09	Medium	94.67	Late
Nana Rajkot 1	2.35	Medium	110.00	Very late
IC 96127	2.23	Medium	102.00	Very late
IC 322186	2.15	Medium	109.67	Very late
IC 132281	2.73	Long	113.67	Very late
IC 204653	2.13	Medium	100.00	Very late
IC 204666	2.35	Medium	101.67	Very late
IC 204681	2.23	Medium	92.33	Late
IC 204983	2.53	Long	94.67	Late
IC 204496	2.33	Medium	92.67	Late
IC 199435-E	2.36	Medium	99.67	Very late
IC 204526	2.13	Medium	107.33	Very late
IC 204528	2.20	Medium	108.00	Very late
IC 127278	3.12	Long	113.00	Very late
IC 199433	3.07	Long	104.00	Very late
NIC 8486	2.59	Long	94.67	Late
NIC 17326	2.12	Medium	103.00	Very late
KR 77	2.26	Medium	103.67	Very late
NIC 17336	2.55	Long	105.00	Very late
NIC 17598	2.19	Medium	106.33	Very late
Mean	2.34		103.00	
S. Em ±	0.06		3.87	
C.D. at 5%	0.18		10.91	
CV%	4.98		6.52	

genotypes were grouped as four locules per capsule in 37 genotypes and six locules per capsule in 3 genotypes. Based on the capsule shape, genotypes were grouped into tapered (13 genotype), narrow oblong (9 genotypes) and broad oblong (18 genotypes) types. Based on the number of capsules per leaf axil, genotypes were grouped

into two, *i.e.* one (36 genotypes) and more than one (4 genotypes) capsule per leaf axil. Based on capsule arrangement, genotypes were grouped into alternate (13 genotypes), opposite (25 genotypes) and cluster (2 genotypes) types. Based on variations in number of capsules per plant, genotypes were grouped into three

Table 3. Identification and grouping of black sesame genotypes based on number of capsules per leaf axil, number of capsules per plant, capsule arrangement and capsule beak

Genotypes	Number of capsules per leaf axil	Number of capsules per plant	Group	Capsule arrangement	Capsule beak
IC 43063	One	42.33	Moderate	Opposite	Long
Malvan 1	One	45.33	Moderate	Opposite	Short
Vinimik 81	One	53.67	Moderate	Opposite	Long
TNAU 12	More than one	41.33	Moderate	Alternate	Long
RJS 190	One	59.67	Moderate	Opposite	Long
Jira 24	One	60.00	Moderate	Opposite	Short
Bhuva 2	One	50.33	Moderate	Opposite	Short
Khadkala 1	One	44.67	Moderate	Opposite	Long
Khadkala 5	One	44.00	Moderate	Opposite	Long
Khadkala 7	One	37.67	Less	Alternate	Long
Nana bhamodara 5	One	36.00	Less	Cluster	Short
Hathigadh 1-3	More than one	35.67	Less	Opposite	Short
Mota Liliya 2	One	62.67	Moderate	Opposite	Long
Lalavadar 6	One	39.00	Less	Opposite	Long
Ansodar 3	One	35.67	Less	Opposite	Long
Lathi 3	One	55.00	Moderate	Opposite	Long
Keriya 5	One	49.33	Moderate	Opposite	Long
Keriya 6	One	41.00	Moderate	Opposite	Short
Keriya 8	More than one	32.67	Less	Alternate	Long
Keriya 11	More than one	44.00	Moderate	Alternate	Long
Liliya 1	One	50.00	Moderate	Alternate	Long
Nana Rajkot 1	One	58.00	Moderate	Alternate	Long
IC 96127	One	49.33	Moderate	Alternate	Long
IC 322186	One	50.33	Moderate	Opposite	Long
IC 132281	One	54.00	Moderate	Alternate	Long
IC 204653	One	74.00	Moderate	Alternate	Short
IC 204666	One	55.00	Moderate	Cluster	Short
IC 204681	One	65.67	Moderate	Opposite	Short
IC 204983	One	42.00	Moderate	Opposite	short
IC 204496	One	46.00	Moderate	Opposite	Long
IC 199435-E	One	50.00	Moderate	Opposite	Long
IC 204526	One	34.67	Less	Opposite	Long
IC 204528	One	46.00	Moderate	Opposite	Long
IC 127278	One	47.67	Moderate	Opposite	Short
IC 199433	One	50.67	Moderate	Opposite	Short
NIC 8486	One	53.33	Moderate	Opposite	Long
NIC 17326	One	40.00	Moderate	Alternate	Long
KR 77	One	42.00	Moderate	Alternate	Short
NIC 17336	One	48.00	Moderate	Alternate	Short
NIC 17598	One	57.67	Moderate	Alternate	Long
Mean		48.10			
S. Em ±		2.82			
C.D. at 5%		7.94			
CV%		10.16			

categories as, moderate (40-100) with thirty-three genotypes and less (\hat{A} 40) with seven genotypes. The number of capsules per plant ranged from 42.33 (IC 43063) to 57.67 (NIC 17598) with a mean of 48.10. Based on variation in capsule length, genotypes were grouped

into two categories as medium (< 1.5 cm) with thirty genotypes and long (1.5-2.5 cm) with ten genotypes. The capsule length ranged from 1.82 cm (IC 43063) to 2.19 cm (NIC 17598) with a mean of 2.34 cm. Based on the beak of capsule, genotypes were grouped into two

Capsule characters



Absent:TNAU12
Hairiness of capsule



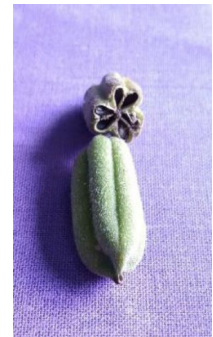
Sparse:Malvan1



Dense:Jira 24



Four: IC43063



Six: TNAU 12

Number of locules per capsule



Tapered:Khadkala 7
Shape of capsule



Narrow oblong: RJS190



Broad oblong: Hathigadh 1-3



Medium: IC 43063



Long: Bhuva 2

Length of capsule



Short beaked: Malvan 1



Long beaked: Lathi 3

Beak of capsule

Figure 1. Identification of black sesame genotypes on the basis of hairiness of capsule, number of locules per capsule, shape of capsule, length of capsule and beak of capsule

categories as, short (14 genotypes) and long (26 genotypes) beaked types.

On the basis of capsule morphological characteristics, genotype identification keys were prepared (Figure 3).

The genotypes viz., Malvan 1, RJS 190, Khadkala 1, Keriya 5, Nana Rajkot 1, IC 96127, IC 204983 and NIC 17326 were having similar capsule morphology viz., moderate number of capsule per plant, narrow oblong



One: Khadkala 7

Number of capsules per leaf axil



More than one: Hathigadh 1-3



Alternate: Khadkala 7

Arrangement of capsule



Opposite: Keriya 6



Cluster: IC 204666

Figure 2. Identification of black sesame genotypes on the basis of number of capsules per leaf axil and arrangement of capsule

shape of capsule, four number of locules per capsule, sparse hairiness of capsule, except absent in Khadkala 1, medium length of capsule, except long in IC 204983, one capsule per leaf axil, long beak of capsule, except short in Malvan 1 and IC 204983, opposite arrangement of capsule, except alternate in (Nana Rajkot 1, IC 96127 and NIC 17326).

The genotypes TNAU 12, Jira 24, Bhuva 2, Khadkala 5, Mota Liliya 2, Keriya 6, Keriya 11, Liliya 1, IC 204653, IC 204666, IC 204681, IC 204528, IC 127278, NIC 8486

and KR 77 were having similar capsule morphology viz., moderate number of capsule per plant, except less in (Nana bhamodara 5, Hathigadh 1-3 and Lalavadar 6), broad oblong shape of capsule, four number of locules per capsule, except six in (TNAU 12, Khadkala 5 and Lalavadar 6), sparse hairiness of capsule, except absent in TNAU 12 and dense in (Jira 24, Lalavadar 6, IC 204666, IC 204681 and IC 204528), medium length of capsule, except long in (TNAU 12, Bhuva 2, Khadkala 5, Mota Liliya 2, IC 132281, IC 127278 and NIC 8486), one capsule per leaf axil, except more than one in (TNAU 12,

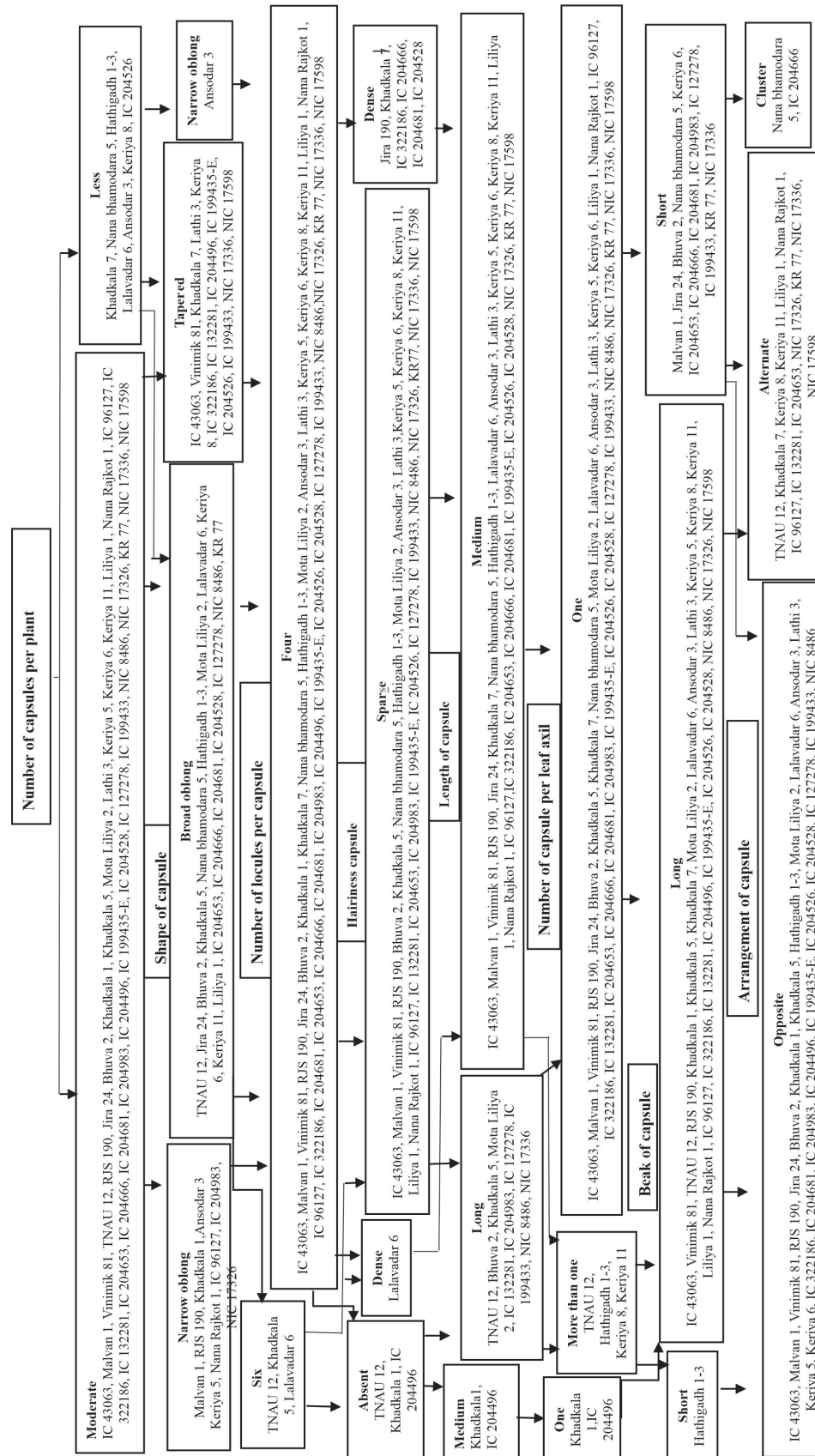


Figure 3. Black sesame genotypes identification keys on the basis of capsule morphological characters

Hathigadh 1-3 and Keriya 11), long beak of capsule, except short in (Jira 24, Bhuva 2, Nana bhamodara 5, Hathigadh 1-3, Keriya 6, IC 204653, IC 204666, IC 204681, IC 127278 and KR 77), opposite arrangement of capsule, except alternate in (TNAU 12, Keriya 11, Liliya 1 and KR 77) and cluster in (Nana bhamodara 5 and IC 204666).

Genotypes IC 43063, Vinimik 81, Khadkala 7, Lathi 3, Keriya 8, Ansodar 3, IC 322186, IC 132281, IC 204496, IC 199435-E, IC 204526, IC 199433, NIC 17336 and NIC 17598 were having similar capsule morphology viz., moderate number of capsule per plant, except less in Keriya 8, Ansodar 3 and IC 204526, tapered shape of capsule, except narrow oblong in Ansodar 3, four number of locules per capsule, sparse hairiness of capsule, except absent in IC 204496 and dense in Khadkala 7 and IC 322186, medium length of capsule, except long in IC 132281, IC 199433 and NIC 17336, one capsule per leaf axil, except more than one in Keriya 8, long beak of capsule, except short in IC 199433 and NIC 17336, opposite arrangement of capsules, except alternate in Khadkala 7, Keriya 8, IC 132281, NIC 17336 and NIC 17598.

CONCLUSION

Simple and reliable morphological characteristics are needed for genetic purity assessment and genotype

characterization. The study suggested that capsule morphological characteristics were useful in broad classification of forty different genotypes of black sesame.

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