GMR
The Original

PHENOTYPIC CHARACTERIZATION OF SESAME'S GENETIC STOCK BY D2 SCHEME

Dr. Kirtikumar N. Uikey[1*], D. T. Deshmukh[2], V. G. Atkare[3], S. P. Patinge[4]

[1*]Assistant Professor of Agricultural Botany(C), University - Dr. PDKV, Akola, Maharashtra, Email - kirtikumar.uikey405@gmail.com, orchid id - 0009-0006-4326-2563
[2]Professor of Agricultural Botany, University - Dr. PDKV, Akola, Maharashtra, Email - dindesh62@gmail.com, orchid id - 0009-0006-7079-3570
[3]Associate Dean, College of Agriculture, Mul. University - Dr. PDKV, Akola, Maharashtra, Email - vilasatkarep@gmail.com, orchid id - 0009-0001-2588-5357
[4]Assistant Professor of Agricultural Botany, University - Dr. PDKV, Akola, Maharashtra, Email - shyampatinge@gmail.com, orchid id - 0009-0004-9764-4538

ABSTRACT
The investigation performed at three places (Akola, Nagpur & Selsura) in kharif-2019 for characterization of eleven measures to assess phenotypic differences in sesame genetic stock. Seasonal variance for genotype performed highly significant differences for all types excluding capsule breadth. Sixty genetic stock fell into eighteen divisions, division I got largest consisting thirty genotypes. Uppermost intra Division distance reported for division II (13.03) and greatest inter-division relation exhibited between division X and XIV (62.41) showing more diversity there. None Division mean confined genotype with all expected measures, which can be directly designated and exploited. Highest mean given by Division XVIII through plant height (64.88), no. of branches/plant (2.00), no. of capsule/plant (22.64) and seed yield/plant (3.73). The genotypes from maximum inters can used in creating genetic variation of crop.

KEYWORDS: Sesame, Diversity, D2, Phenotypic diversity.

INTRODUCTION
Sesame (Sesamum indicum L.), one of the oldest and globally important oilseed crop from very long time. India, Philippines, China, Buma, Korea, Sri Lanka Thailand and Pakistan etc. and in India Madhya Pradesh, Andhra Pradesh, Telangana, Rajasthan, West Bengal and Gujrat known as important potential area for sesame. It's mainly for oil extraction as it has many medicinal and pharmaceutical ingredients. Seeds, more nutritive and an important for oil source (43-58%), protein (17-24%) and carbohydrates (13.9%) and reported source of sulphur comprising amino acids like methionine & cystine. It has high with good quality of PUFA like oleic acid (43%), linoleic acid (36%), palmitic acid (11%) and stearic acid (7%) and prefer essential for normal growth and improvement. It has resistance to rancidity. Experimental and epidemiological studies proven, polyunsaturated fatty acids have good cardiovascular defensive effects. These ingredients responsible to lower the blood pressure and defense development of hypertension (Sankar et al., 2005).

Importance of the study: Sesame is indeterminate and autogamous crop. Cross pollination ranges from (5 to 60%) depends upon insect spreading, environmental status and availability of other vegetation (Yermamos, 1980). It stands at low productivity, when compared to additional oil seed crops. The reasons behind this, growing areas reduced because of lack of adaptability, biotic and abiotic entities, shattering, overlap the reproductive, maturity and drying phases. By focusing all these, significant advancement needed in all aspect of the crop. Keeping in view these aspects, present investigation taken up with fifty-seven genotypes with three checks of sesame.

Material and methods: The investigational material comprised of sixty genetic stocks of sesame including three check varieties AKT-64, AKT-101 and PKV-NT-11 which obtained from ICAR-NBPGR Regional Station and All India Coordinated Research Project on Sesame Dr. P.D.K.V Campus, Akola, Maharashtra. The material grown in three places viz., Akola, Nagpur and Selsura during kharif-2019. It was grown in randomize block design in three replications. Each line of 3 m with spacing 30 x 10 cm and all recommended agricultural practice adopt to stand healthy crop. Five competitive plants selected randomly for characterization of an observations viz., plant height(cm), no. of branches/plant, no. of capsules/plant, capsule breadth(mm), length of capsule(cm), 1000-seed weight(gm), no. of seed/capsule, oil content(%) and seed yield/plant(gm). Two measures, days to 50% flowering and days to maturity noted on plot basis. The mean of 5 plants from 3 places subjected to statistical analysis as the pooled data. Genetic diversity by Mahalanobis (1936) D2 statistics and dividing of genotypes done on the basis of D2 values as per Tocher's technique as defined by Rao (1952). Mathematical examination done by INDOSTAT program.

RESULT AND DISCUSSION:
Seasonal (kharif-2019) analysis of variance for eleven measures placed in table-1. It showed variance due to genotype exhibited highly significant differences for all measures except capsule breadth. This noted, presence of extensive significant variability among genotypes for seed yield/plant and other contributed measures. Environmental variance

and G x E interaction too found highly significant for whole measures. Similar result proposed by Uikey et al. (2022a) over the season.

Sixty genetic stocks felt into eighteen divisions figure-1 and table-2. Division I reported largest, comprising of 30 genotypes followed by divisions II with 1 genotype, division XVII with 2 genotype and divisions III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XVI and XVIII mono-genotypic divisions, suggesting, regional separation not only cause of high degree of phenotypic variation. They stand together because of morphological differences. Uikey et al. (2022b) and Gayathri and Dijee (2025) earlier reported.

The middling intra and inter division D2 values placed in table-3. Intra division D2 values ranged from 0 to 13.03. Division II (13.03) ranked first followed by division XVII (10.37) and division I (9.80), representing some kind of diversity available within these divisions. This associated with Uikey et al. (2022b) and Indalkar et al. (2025) existed uppermost intra-division distance for division II.

Value for differences between two inters higher compare to intra division, proving, existence of genetic diversity between genotypes in investigation. Most inter division difference exhibited between division X & XIV (62.41) then V and XIV (54.17) and division II and X (53.58). The division IV and X (7.34) showed lower inters distance, indicating genotypes in division were interrelated. Conformity conclusion reported by Divya et al. (2022) and Uikey et al. (2022b). Differences between two inters more, genetic diversity wider among genotypes of respective divisions. Inters showed maximum distance but division mean and per se performance of genotypes from same cluster not significant. Hence, such different genotypes can play essential role in creating genetic variation, whereas selection for particular traits must based on subsequent evaluation of progenies.

The division mean placed in table-4. It realized from the data that significant differences existed for all measures under investigation. The division mean for days to 50% flowering highest in division XII (44.00) and lowest in division XI and division XV (38.33), days to maturity highest in the division VI (102.00) and lowest in division XV (95.33), plant height highest in division XVIII (64.88) and lowest in division XVIII (64.88), no. of branches/plant highest in division XVIII (2.00) and lowest in division X (1.33), no. of capsules/plant maximum in division XVIII (22.64) and minimum in division XVI (11.33), capsule breadth maximum in the division VII and XV (5.73) and lowest in division VIII (4.57), length of capsule maximum in division XIII (2.50) and minimum in division XVIII (2.03), 1000-seed weight maximum in division VI (3.61) and minimum in division III and V (3.43), no. of seeds/capsule in division XV (58.00) and minimum in division XVIII (49.93), oil content highest in division X (51.88) and lowest in division XIV (40.81) and seed yield/plant highest in division XVIII (3.73) and lowest in division XVI (2.19). This result explained that the selection of genotype showing highest mean for character can use in crossing programme for advancement of that character. Similar consequence proposed by Uikey et al. (2022b) for days to 50% flowering, days to maturity, plant height, no. of branches/plant, capsule length, capsule breadth, no. of capsules/plant, no. of seeds/capsule, 1000-seed weight, oil content and seed/plant; Md. Ashfaq et al. (2024) days to 50% flowering, days to maturity, plant height, no. of branches/plant, no. capsules/plant, 1000-seed weight, no. of seeds/capsule, oil content and seed yield/plant.

Division XVIII showed highest mean for plant height, no. of branches/plant, no. of capsule/plant and seed yield/plant. The result accordingly proposed by Uikey et al. (2022b) for division VXI with measures no. of branches/plant and seed yield/plant; Ashfaq et al. (2024) for division II with measures no. of capsule/plant and seed yield/plant; Indalkar et al. (2025) for division VI with measures plant height and seed yield/plant; Petkar et al. (2026) for division IV with measures no. of branches/plant, no. of capsule/plant and seed yield/plant. The promising genotypes from this division with high mean values for diverse measures can be used directly for adaptation or may be used as parentages in upcoming crossbreeding programme, based upon the goal of the breeding programme to find superior transgressive segregants.

Among eleven measures which rank first frequently, its corresponding per cent contribution to genetic divergence more placed table-5 and figure-2. The result explained, oil content (43.95%) contributed most to divergence keeping 778 times rank first, chased by days to 50% flowering (13.50%), capsule breadth (10.23%) by 181 times, 1000-seed weight (8.36%) by 148 times, days to maturity (7.01 %) by 124 times, no. of seed/capsule (5.76%) by 102 times, length of capsule (4.58%) by 81 times, no. of capsules/plant (3.67%) by 65 times, no. of branches/plant (2.32%) by 41 times, seed yield/plant (0.34%) by 6 times and plant height (0.28%) by 5 times rank first to the divergence in dropping order.

Initially placed by Uikey et al. (2022b) and Indalkar et al. (2025) for oil content; Ashfaq et al. (2024) maximum for oil content and minimum for plant height. Among the eleven measures investigated, six measures viz., oil content, days to 50% flowering, capsule breadth, 1000-seed weight, days to maturity and no. of seed/capsule combine contributed 88.91% to the whole divergence. These measures should play important role if give preference in crossbreeding and selecting of f2 and upcoming populations.

Table-1. Seasonal analysis of variance over three places.

Sr. no.	Sources of variation	d. f.	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches plant-1	No. of capsule plant-1	Capsule breadth (mm)	Length of capsule (cm)	1000 Seed weight (g)	No. of seed capsule-1	Oil content (%)	Seed yield plant-1 (g)
			Mean sum of square										

1.	Genotypes	1.02**	4.77**	15.69**	213.88**	0.41**	93.70**	0.36	0.08**	0.02**	22.10**	76.67**	5.69**
2.	Environments	21.65**	3267.11**	6348.17**	159016.67**	73.42**	15325.45**	5.70**	5.31**	0.53**	1962.32**	399.38**	852.19**
3.	G x E	0.68**	5.46**	15.54**	171.96**	0.35**	92.80**	0.58**	0.09**	0.01**	23.73**	2.58**	5.97**
4.	Pooled error	0.42	2.88	8.26	84.58	0.16	13.20	0.28	0.03	0.01	11.69	0.12	0.76

* Significant at 5 % level ** Significant at 1 % level

Table-2. Seasonal dividing of sixty Sesame's Genetic Stock by means of Tocher's method.

Division number	Number of genetic stocks	Name of genetic stocks included in the Division
Division I	30	EC- 370450, ES-46-A, Tireendre Local, IC- 203955, SI-2039-A, SI-3299-A, IC- 204054, IC- 203892, IC- 203954, EC- 370382, IC- 204060, IC-204037, NIC-9852-A, GRT-8622, EC- 370362, IS-157-A, IC- 203883, DS-46-3, IC- 203889, SI-1782-A, IC- 204045, GRT-839-A, IC- 203959, IC- 204058, EC- 370455, SI-3278, IS-93-B, IC- 203920, IC- 204062, EC-370430
Division II	13	EC- 370402, IS-520, EC- 370345, IC- 203931, EC- 370374, EC- 370442, IC- 203884, EC- 370373, IC- 204056, IS-562-A, NIC-8600-A, IC-204047, JLS-709-1
Division III	1	IC- 204049
Division IV	1	IC- 204063
Division V	1	IC- 203888
Division VI	1	AKT-101
Division VII	1	TKG-15-2-2
Division VIII	1	EC- 370371
Division IX	1	EC- 370354
Division X	1	IC- 203887
Division XI	1	IC- 203886
Division XII	1	IS-24-A
Division XIII	1	EC- 370372
Division XIV	1	NIC-17868
Division XV	1	PKV-NT-11
Division XVI	1	NIC-54-164-B
Division XVII	2	EC- 370343, AKT-64
Division XVIII	1	IC- 204059

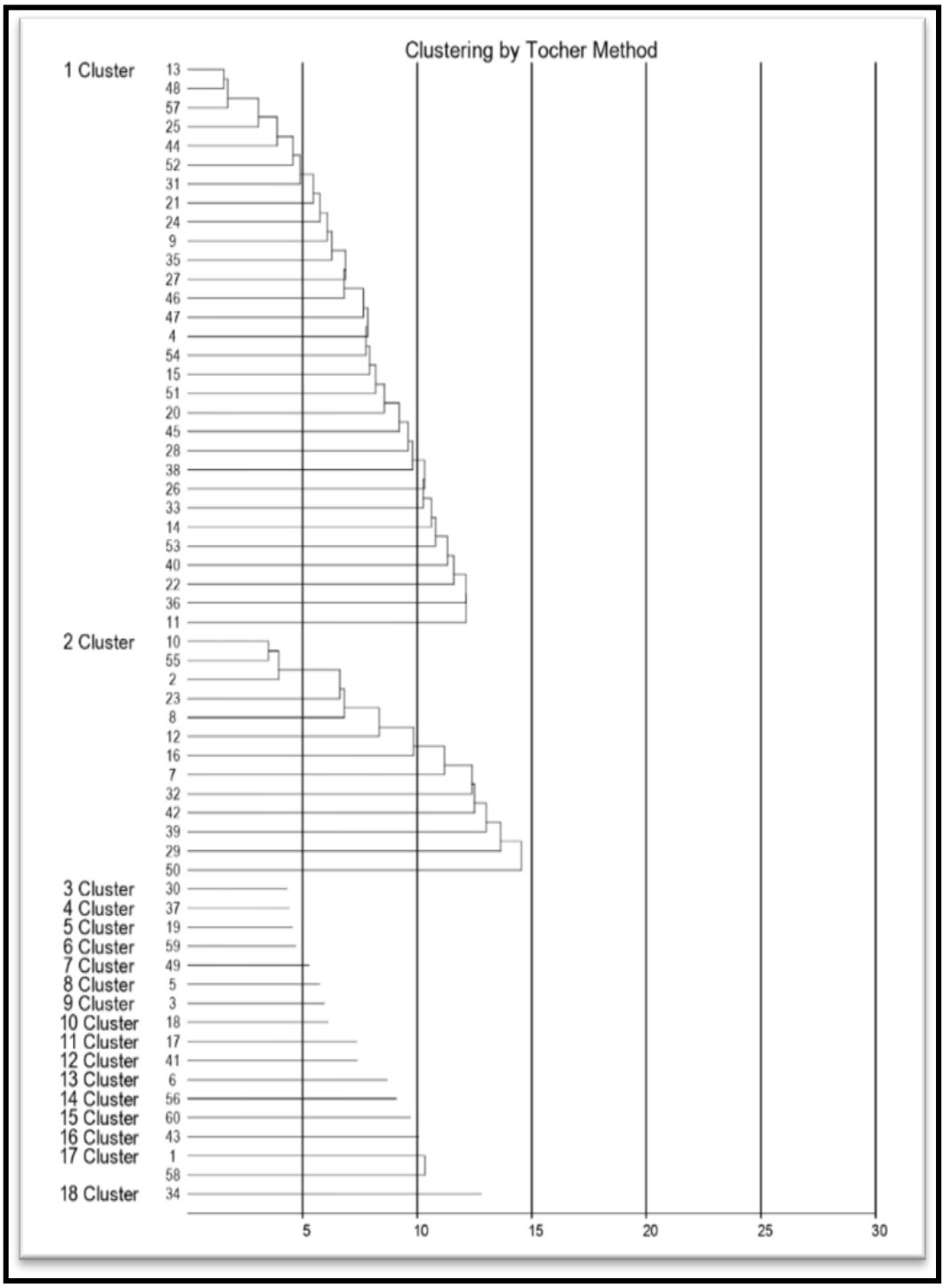

Figure-1. Dividing sixty Sesame's Genetic Stock by means of Tocher's Scheme.

Table-3. Seasonal intra and inter division values over three places.

Division No.	Division I	Division II	Division III	Division IV	Division V	Division VI	Division VII	Division VIII	Division IX	Division X	Division XI	Division XII	Division XIII	Division XIV	Division XV	Division XVI	Division XVII	Division XVIII
Division I	9.80	25.10	24.30	13.69	14.67	13.69	14.36	14.14	17.81	17.22	16.40	19.01	22.28	36.97	17.39	17.72	25.00	19.80
Division II		13.03	17.72	43.16	36.12	35.52	22.47	30.36	16.65	53.58	26.63	31.25	18.66	17.14	29.92	18.32	40.20	31.81
Divis			0.0	44.	23.	35.	27.	26.	23.	43.	22.	17.	24.	20.	44.	20.	26.	19.

ion III			0	89	91	52	46	73	62	69	94	98	70	52	49	79	94	45
Division IV				0.00	18.66	12.25	22.18	8.58	21.81	7.34	20.61	29.27	25.10	48.86	19.80	28.09	23.91	36.72
Division V					0.00	22.09	28.20	12.39	22.66	13.91	9.12	27.67	36.84	54.17	23.33	22.28	28.09	14.98
Division VI						0.00	10.37	15.92	27.46	18.23	26.63	23.72	29.92	42.12	21.07	36.24	32.95	20.70
Division VII							0.00	20.98	16.89	32.60	34.81	12.74	30.47	33.99	13.32	25.10	26.01	21.07
Division VIII								0.00	11.36	15.44	12.67	27.46	20.52	33.52	21.07	24.60	20.43	23.14
Division IX									0.00	31.70	14.75	30.25	15.84	19.10	10.76	12.89	23.23	29.70
Division X										0.00	18.32	33.99	39.82	62.41	28.62	30.36	30.91	31.47
Division XI											0.00	40.96	18.84	32.60	23.23	16.48	34.57	23.43
Division XII												0.00	34.11	42.25	34.57	30.14	13.25	26.73
Division XIII													0.00	9.86	33.52	23.04	29.92	46.65
Division XIV														0.00	46.65	30.25	41.99	51.12
Division XV															0.00	20.98	33.06	28.09
Division XVI																0.00	32.15	29.48
Division XVII																	10.37	37.82
Division XVIII																		0.00

Table-4. Seasonal division mean over three places.

Division No.	Days to 50 % flowering	Days to maturity	Plant height (cm)	No. of branches plant-1	No. of capsules plant-1	Capsule breadth (mm)	Length of capsule (cm)	1000-seed weight (g)	No. of seed capsule-1	Oil content (%)	Seed yield plant-1 (g)
Division I	40.46	99.82	55.71	1.80	17.40	5.36	2.20	3.48	55.63	47.90	3.14
Division II	40.08	98.85	55.64	1.87	18.53	5.27	2.20	3.49	55.43	42.59	3.38
Division III	42.00	99.33	54.93	1.60	18.31	4.92	2.10	3.43	50.67	43.65	3.00
Division IV	40.67	100.00	55.77	1.63	15.43	5.00	2.27	3.54	57.77	50.47	2.83
Divisi	39.33	97.33	49.73	1.67	18.23	4.83	2.10	3.43	50.87	49.73	2.83

on V											
Division VI	41.00	102.00	56.47	1.80	19.17	5.53	2.23	3.61	54.20	48.55	3.36
Division VII	41.33	99.67	55.73	1.87	19.10	5.73	2.07	3.59	56.73	46.25	3.49
Division VIII	40.33	99.33	58.43	1.62	20.43	4.57	2.17	3.52	55.40	48.42	3.56
Division IX	39.33	96.00	57.70	1.53	18.93	5.00	2.17	3.53	57.33	45.47	3.47
Division X	40.33	100.00	56.10	1.33	14.60	5.07	2.17	3.49	55.13	51.88	2.83
Division XI	38.33	97.67	55.37	1.53	18.17	4.83	2.30	3.44	52.87	47.62	3.18
Division XII	44.00	99.67	52.40	1.83	17.73	5.50	2.10	3.48	55.33	46.95	3.23
Division XIII	41.00	100.00	56.50	1.70	17.23	5.00	2.50	3.50	57.77	44.11	3.21
Division XIV	41.33	100.00	58.37	1.40	17.87	4.97	2.33	3.56	56.00	40.81	3.26
Division XV	38.33	95.33	57.97	1.87	19.20	5.73	2.20	3.55	58.00	48.21	3.62
Division XVI	39.33	97.00	57.31	1.73	11.33	5.07	2.10	3.45	55.75	45.39	2.19
Division XVII	43.50	96.50	58.02	1.63	17.84	5.03	2.25	3.49	56.19	48.17	3.16
Division XVIII	40.00	99.67	64.88	2.00	22.64	5.40	2.03	3.47	49.93	47.55	3.73

Table-5. Seasonal comparative contribution of eleven measures to genetic diversity over three places.

Sr.No.	Measures	Times ranked 1st	Contribution (%)
1.	Days to 50 % flowering	239	13.50
2.	Days to maturity	124	7.01
3.	Plant height (cm)	5	0.28
4.	Number of branches plant-1	41	2.32
5.	Number of capsules plant-1	65	3.67
6.	Capsule breadth (mm)	181	10.23
7.	Length of capsule (cm)	81	4.58
8.	1000 Seed weight (g)	148	8.36
9.	Number of seed capsule-1	102	5.76
10.	Oil content (%)	778	43.95
11.	Seed yield plant-1 (g)	6	0.34

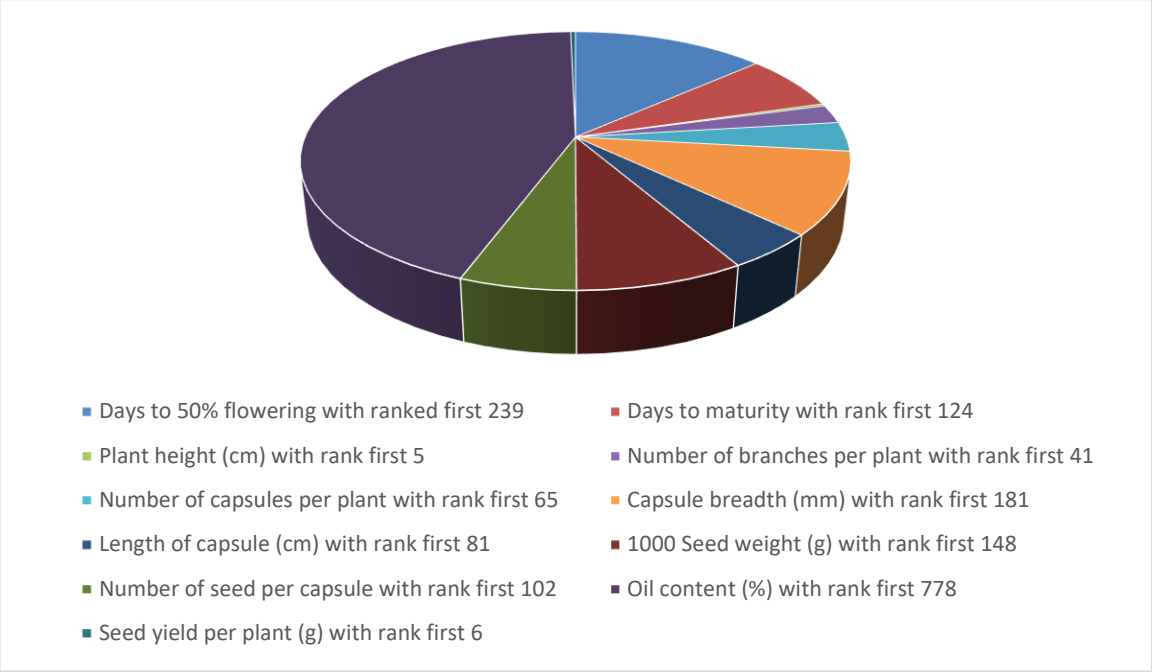

Figure-2. Seasonal comparative contribution of eleven measures to genetic diversity over three places.

CONCLUSIONS: Differences between two inters more, genetic diversity wider among genotypes of respective divisions. Inters showed maximum distance but division mean and per se performance of genotypes from same division not significant. Hence, such different genotypes can play essential role in creating genetic variation. The genotypes can also use for biotic and abiotic stress management of the crop.

ACKNOWLEDGEMENT: The writers are grateful to NBPGR, RS, Akola and AICRP on Sesame to provide the genetic stock to conduct this investigation.

REFERENCES:

1. Ashfaq Md., K. Jhansi Rani, D. Padmaja, Praduman Yadav and Usha Kiran Betha. 2024. Analysis of genetic diversity in sesame (Sesamum indicum L.) germplasm lines based on agro-morphological traits and SSR markers. Electronic Journal of Plant Breeding. 15(4): 1-10.
2. Divya K., T. Shobha Rani, D. Padmaja and T. Kiran Babu. 2022. Characterization (Diversity Analysis) in Germplasm of Sesame (Sesamum indicum L.). Biological Forum – An International Journal. 14(1): 204-209(2022).
3. Gayathri G and Dijee Bastian. 2025. Genetic Variability and Diversity Analysis in Sesame (Sesamum indicum L.). Journal of Sustainable Technology in Agriculture. 1(1): 1-15.
4. Indalkar Parth K, G. B. Chaudhari, P. S. Munge, V. Y. Pawar and G. D. Sirsat. 2025. Genetic diversity study in Sesame germplasm (Sesamum indicum L.). International Journal of Advanced Biochemistry Research. SP-9(8): 562-566.
5. Mahalanobis, P. C. 1936. On the generalized distance in statistics. Proceedings of National Institute of Sciences. India. 2: 49-55.
6. Petkar D. S., B. D. Gite, S. M. Shinde, R. A. Sayyad, K. S. Tekade and U. A. Dhande.2026. Genetic diversity studies in Sesame (Sesamum indicum L.). International Journal of Agriculture and Food Science. 8(12): 352-356.
7. Rao, C.R., 1952. Advanced Statistical Methods in Biometric Research. John Wiley Sons, New York, 390p.
8. Sankar, D., G. Sambandam, R. M. Rao and K. V. Pugalendi. 2005. Modulation of blood pressure, lipid profiles and redox status in hypertensive patients taking different edible oils. Clin Chim Acta. 355: 97-104.
9. Uikey Kirtikumar N., D. T. Deshmukh, E. R. Vaidya, S. S. Gomashe, D. V. Durge and R. D. Walke. 2022a. D2 Analysis in Sesame (Sesamum indicum L.). International Journal of Agricultural Invention. 7(2): 120-125.
10. Uikey Kirtikumar N., D. T. Deshmukh, E. R. Vaidya, N. A. Mohurle, S. S. Gomashe, D. V. Durge and R. D. Walke. 2022b. Genetic divergence study among the germplasm of sesame (Sesamum indicum L.). The Pharma Innovation Journal. 11(12): 4009-401.
11. Yermamos D. M., W. R. Fehr and H. H. Hadley (Eds). 1980. Sesame. In: Hybridization of Crop Plants. Amer. Society of Agron. (CSSA), Madison.