Eco. Env. & Cons. 30 (May Suppl. Issue) : 2024; pp. (S216-S218)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2024.v30i03s.039

Genetic investigation of radish (*Raphanus sativus* L.) genotypes under hill zone of Karnataka, India

G. Rakshitha[1], V. Srinivasa[2], Devaraju[3], S.Y. Chandrashekar[4] and M. Ganapathi[5]

[1,2,3]Department of Vegetable Science, College of Horticulture, Mudigere 577 132, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga 577 201 Karnataka, India
[4]Department of Horticulture, Agricultural and Horticultural Research Station, Madikeri, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga 571201, Karnataka, India
[5]Department of Crop Physiology, College of Agriculture, Shivamogga, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga 577 201, Karnataka, India

(Received 11 September, 2023; Accepted 30 October, 2023)

ABSTRACT

Twenty radish (*Raphanus sativus* L.) genotypes were evaluated during summer 2022-23 at Department of Vegetable Science, College of Horticulture, Mudigere to study the genetic variability, heritability and genetic advance as a per cent of mean in radish. Analysis of variance showed highly significant differences among all the genotypes for all the characters under study. High heritability coupled with high genetic advance as a per cent of mean was recorded for plant height, number of leaves, leaf length, leaf width, days to harvest, root length, root diameter, root girth, root weight, root volume, root yield per plot and root yield per hectare, suggesting that these traits can be improved through direct selection due to additive gene action.

Key words: *Radish, Genetic variability, Heritability, Genetic advance.*

Introduction

Radish (*Raphanus sativus* L. 2n = 2x = 18) belongs to the family Cruciferae, probably originated from Europe or Asia (Thompson and Kelly, 1957) is one of the most popular root vegetable crops, which is cultivated for its enlarged edible roots and leaves in both tropical and temperate climate. Roots are a good source of vitamin-C (ascorbic acid) containing 15-40 mg per 100 g of edible portion and supplies a variety of minerals. The area under radish in India is 209 thousand hectares, with an annual production of 3,346.71 metric tons. It is mainly cultivated in West Bengal, Bihar, Uttar Pradesh, Karnataka, Punjab and Haryana (Anon., 2022).

Genetic variability is an important factor for selecting the best genotypes for growing at an optimum period and making rapid improvements in yield and other related characteristics because most plant characteristics are polygenic in nature and are influenced by the environment. Therefore, the present investigation was conducted to study the genetic variability for certain characters in radish genotypes.

Materials and Methods

The experiment was conducted at College of Horti-

([1]PG Scholar, [2]Head (HOD), [3]Assistant Professor, [4]Professor and Station Head, [5]Assistant Professor)

culture, Mudigere during *Summer* season 2022-2023 with twenty genotypes of radish which are listed in the Table 1. The experiment was laid out in a Randomized Block Design with three replications. The seeds were sown at a distance of 30 cm between row to row and 10 cm between plants. All the recommended cultural operations were followed and observations were recorded in five randomly selected plants per replication for each genotype.

The analysis of variance was carried out as suggested byPanse and Sukhatme (1957). The genotypic and phenotypic co-efficient of variation were obtained by the method given by Burton and Devane (1953). The heritability (broad sense) and genetic advance as percent of mean were estimated by using the formula described by Robinson *et al.* (1949) and Johnson *et al.* (1955), respectively.

Results and Discussion

The genetic variability was measured by range, mean, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), broad-sense heritability (h^2), genetic advance (GA) and genetic advance as per cent of mean (GAM) to determine the degree to which the observed variations are caused by genetic factors.

Table 2 indicates the degree of variability among the genotypes. The range of variation for plant height (15.29-31.61 cm), number of leaves (7.73-11.46), leaf length (12.80-35.80 cm), leaf width (6.66-9.68 cm), spread of the plant (N-S) (28.61-35.99 cm), spread of the plant (E-W) (25.74-40.28 cm), days to harvest (24.33-45.67), root length (9.96-25.01 cm), root diameter (19.29-32.22 mm), root weight (47.60-155.67 g), root volume (25.60-103.00 cc), root yield per plot (2.40-7.59 kg), root yield per hectare (16.31-43.67 t), ascorbic acid (12.32-28.30 mg/100 g), reducing sugars (1.22-2.99 %), non-reducing sugars (0.32-1.32 %) and total sugars (1.65-4.20 %).

The genotypic and phenotypic coefficient of variation were varied for all the traits studied. High GCV and PCV were noticed forroot length, root weight, root volume, root yield per plot, root yield per hectare, ascorbic acid, reducing sugars, non reducing sugars and total sugars. The narrow difference between the GCV and PCV indicates the less environmental influence on the expression of the characters. It also suggests that these features have a greater degree of variability, which might be useful for further selection. These results are similar with results of Jabal *et al*. (2015) for root length and root weight, Singh *et al*. (2022) for root length and root yield.

The high broad sense of heritability was shown by plant height (96.78 %), number of leaves (63.88 %), leaf length (98.02 %), leaf width (92.22 %), spread of the plant (N-S) (82.17 %), spread of the plant (E-W) (93.50 %), days to harvest (96.14 %), root length (98.60 %), root diameter (72.58 %), root girth (97.60 %), root weight (97.90 %), root volume (99.18 %), root yield per plot (98.78 %), root yield per hectare (98.46 %), ascorbic acid (97.72 %), reducing sugars (79.02 %), non-reducing sugars (99.73 %) and total sugars (85.57 %).

The high estimates of heritability coupled with high genetic advance over per cent of mean were observed for plant height, leaf length, spread of the plant (E-W), days to harvest, root length, root diameter, root girth, root weight, root volume, root yield per plot, root yield per hectare, ascorbic acid, reducing sugars, non-reducing sugars and total sugars content suggesting that these characters can be improved through direct selection due to predomi-

Table 1. List of radish genotypes used in the experiment

Sl. No.	Name of the genotype	Source of collection	Sl. No.	Name of the genotype	Source of collection
1	Kashi Hans	IIVR, Varanasi	11	Arka Nishant	IIHR, Bengaluru
2	Kashi Sweta	IIVR, Varanasi	12	White Sparkle Tip	Gennext seeds, Bengaluru
3	Kashi Mooli – 40	IIVR, Varanasi	13	Chinese Pink	Sungro seeds, New Delhi
4	Kashi Aardra	IIVR, Varanasi	14	Palak Patta	Abhi seeds, Hubli
5	VRRAD – 4	IIVR, Varanasi	15	White Star	Orbi seeds, Bengaluru
6	VRRAD – 91	IIVR, Varanasi	16	VBGH – 507	Orbi seeds, Bengaluru
7	VRRAD – 199	IIVR, Varanasi	17	ORBI- 0527	Orbi seeds, Bengaluru
8	VRRAD – 131	IIVR, Varanasi	18	Scarlet Globe	Tokai seeds co. New Delhi
9	VRRAD – 200	IIVR, Varanasi	19	Red Radish	Kraft seeds, New Delhi
10	VRRAD – 11	IIVR, Varanasi	20	Pusa Chetki	IARI, New Delhi

Table 2. Mean, range and genetic components for morphological parameters in radish

Characters	Mean	Range	GV	PV	GCV (%)	PCV (%)	h^2 (%)	GA	GAM (%)
Plant height (cm)	27.72	15.29-31.61	17.40	17.98	15.05	15.30	96.78	8.45	30.49
Number of leaves	9.58	7.73-11.46	0.74	1.16	7.65	12.82	35.60	0.66	9.40
Leaf length (cm)	20.72	12.80-35.80	13.31	13.57	17.61	17.78	98.02	7.44	35.90
Leaf width (cm)	8.27	6.66-9.68	0.69	0.74	10.04	10.46	92.22	1.64	19.86
Plant spread (N-S) (cm)	32.03	28.61-35.99	4.19	5.10	6.39	7.05	82.17	3.82	11.94
Plant spread (E-W) (cm)	32.24	25.74-40.28	11.91	12.74	10.70	11.07	93.50	6.87	21.32
Days to harvest	36.12	24.33-45.67	33.27	34.61	15.97	16.29	96.14	11.65	32.26
Root length (cm)	18.88	9.96-25.01	16.31	16.54	21.39	21.54	98.60	8.26	43.75
Root diameter (mm)	23.93	19.29-32.22	12.60	17.36	14.84	17.41	72.58	6.23	26.03
Root girth (cm)	9.29	6.72-11.76	2.39	2.45	16.66	16.86	97.60	3.14	33.90
Root weight (g)	105.10	47.60-155.67	698.57	713.52	25.15	25.42	97.90	53.87	51.26
Root volume (cc)	72.11	25.60-103.00	464.70	468.53	29.89	30.02	99.18	44.22	61.33
Root yield per plot (kg)	5.17	2.40-7.59	1.76	1.78	25.68	25.84	98.78	2.72	52.58
Root yield per hectare (t)	33.75	16.31-43.67	62.07	63.04	23.34	23.52	98.46	16.10	47.71
Ascorbic acid (mg/100 g)	18.46	12.32-28.30	12.93	13.23	20.01	20.34	97.72	7.32	39.66
Reducing sugars (%)	1.93	1.22-2.99	0.28	0.35	27.41	30.84	79.02	0.96	50.20
Non -reducing sugars (%)	0.61	0.32-1.32	0.09	0.09	49.87	49.93	99.73	0.62	102.58
Total sugars (%)	2.56	1.65-4.20	0.43	0.51	25.86	27.95	85.57	1.26	49.27

GV= Genotypic variance PV= Phenotypic variance GCV= Genotypic coefficient of variation PCV= Phenotypic coefficient of variation h^2=Heritability GA=Genetic Advance GAM= Genetic advance as per cent of mean

nance additive gene action. Similar results were observed by Mehdi *et al.* (2010) for root diameter, Asima *et al*. (2013) for root weight, Naseeruddin *et al*. (2014) for root yield per plant, Nagar *et al*. (2016) for root length and root diameter and Ullah *et al*. (2017) for root length and root yield.

Acknowledgement

The author is highly thankful to the Head, Department of Vegetable Science, College of Horticulture, Mudigere, KSNUAHS, Shivamogga (Karnataka) for providing essential facilities and support during the research experiment.

Conflict of interest : None

References

Anonymous, 2022, First advance estimates, National Horticulture Board, New Delhi. https://nhb.gov.in

Asima, A., Kumar, S. P. and Parveen, W. K., 2013, Genotypic variation for quantitative and qualitative traits in Asiatic and European carrot (*Daucus carota* L. var. *sativa*). *Indian. J. Plant Genet. Res.* 26(2): 151-154.

Burton, G. W. and Devane, E. M. 1953. Estimating heritability from replicated clonal material. *Agronomy*. 45: 478-481.

Jabal, S., Al Sadi, Y. and Abbos, G. 2015. Variability and phenotypic correlation among yield and some yield components in different genotypes of local radish (*Raphanus sativus* L). *J. Agric. Sci*. 31(1): 121-130.

Johnson, H. W., Robinson, H. F. and Comstock, R. E. 1955. Estimates of genetic and environmental variability in soyabean. *J. Agron.* 47: 314-318.

Mehdi, M., Mir, M. S. and Saleem, T. 2010. Variability and correlation studies in turnip (*Brassica rapa* L.) under cold arid condition. *J. Agric. Biol. Res*. 26(1): 57-63.

Nagar, S. K., Paliwal, A., Tiwari, D., Upadhyay, S. and Bahuguna, P. 2016. Genetic variability, correlation and path study in radish under near temperate conditions of Garhwal hills. *Int. J. Sci. Res. Dev.* 4(9): 174-176.

Naseeruddin, K. H., Singh, V. and Rana, D. K. 2014. Performance of different radish (*Raphanus sativus* L.) varieties suitable under Garhwal Himalaya region. *Sci, Res, J.* 2(12): 2321-7871.

Panse, V. G. and Sukhatme, P. V. 1957. *Statistical Methods for Agricultural Workers*. 2nd Edition ICAR, New Delhi, pp. 324.

Robinson, H. F., Cornstocj, R. E. and Harvey, P. M. 1949. Estimates of heritability and degree of dominance in corn. *Oceanogr*. 41: 353-359.

Singh, B., Kumar, A., Tiwari, K. K., Sudhakar, P., Singh, G. and Banerjee, M.K. 2022. Genetic association analysis in Asiatic radish (*Raphanus sativus* L.) *Indian J. Plant Genet. Res.* 15(2): 121-124.

Thompson, C. H. and Kelley, C. W. 1957. Vegetable Crops. *Mcgraw Hill book co*., Inc. USA.

Ullah, M. Z., Hasan, J., Rahman, A. H. M. A. and Saki, A. I. 2017. Genetic variability, character association and path coefficient analysis in radish (*Raphanus sativus* L.). *The Agriculturists*. 8(2): 22-27.