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Original Research Article

Genetic Variability, Heritability and Genetic Advance in Dill (*Anethum graveolens* L.) Genotypes

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A B S T R A C T

Sixteen genotypes of dill (*Anethum graveolens* L.) with check were evaluated to study the genetic variability on yield and yield contributing and related thirteen attributes *viz*., Plant height (cm), number of branches, number of umbels per plant, number of umbellets per umbel, seed yield per plant (g), number of seeds per umbel, number of seeds per umbellets, test weight (g), oil content (%), days to 1st flowering, days to 50% flowering, days to maturity, germination percentage (%), seed yield per plot (g) using RBD in three replication during 2018-19 at Chilli and Vegetable Research Unit, Dr. PDKV, Akola. The range genotypic and phenotypic coefficient of variation, heritability and genetic advance were calculated. Analysis of variance revealed significant variability for most of the traits studied. The genotypes showed considerable amount of variability for all the traits. Wide range of variability was recorded for seed yield per plot, seed yield per plant, days to 50% flowering and days to maturity. On the basis of mean performance, the genotypes, AKDIL-13 and AKDIL-04 were found to be superior for almost all the attributes. The genotypic and phenotypic coefficients of variation were high (>20%) for seed yield per plot, seed yield per plant and no. of seeds per umbel. The characters *viz*., no. of seed per umbel, seed yield per plot, plant height, days to maturity and seed yield per plant had high genetic and high heritability coupled with high genetic advance and GA as per cent of mean indicating the predominance of additive gene action.

Keywords

Variability, Yield, Heritability and genotype

Introduction

Dill (*Anethum graveolens* L. Anethum sowa 2n = 20) is a seed spice crop and an important aromatic herb which is used for flavouring, tea, pickles and confectionery. Dill leaves are rich in minerals and fibers. The seeds are mainly used for spice, culinary and medicinal purposes. It is also used as a vegetable and an aromatic herb (Sharma 2004). The aroma volatiles of seed and herb of dill have been identified along with several therapeutic properties and the antimicrobial activities of carvone (terpenoid found naturally in many essential oils) isolated from dill seed oil has been reported (Aggarwal *et al.*, 2002). Dill contains carotenoids, vitamin C and polyphenols, the contents of which vary during different stage of its growth. Dill is probably native to South-West Asia or South-East Europe and also has been cultivated since ancient times. In India dill is grown with the name of sowa (*Anethum sowa* L.) also known as Indian dill, in the states of

Rajasthan, Gujarat, Maharashtra, Andhra Pradesh and Madhya Pradesh for its seed. Dill is primarily a summer crop of the temperate region but it has also adapted to grow in warmer areas. In the Northern Indian plains, it is grown during the *rabi* season. Yield is a complex character governed by several other yield attributing characters. Since, most of the yield attributing characters are quantitatively inherited and highly affected by environment, it is difficult to judge whether the observed variability is heritable or not. The present study was undertaken to estimate the variability present in active germplasm of dill and to evaluate the extent of association among yield and yield contributing traits.

Materials and Methods

The experimental material for the present studies consisted of sixteen genotypes were collected from Vidarbha region and one checks (Shiva) collected from NRCSS, Ajmer were evaluated in a randomized complete block design with three replications during *rabi* 2018-19 at at Chilli and Vegetable Research Unit, Dr. PDKV, Akola. The spacing was 60cm x 30cm. All the recommended package of practices and plant protection measures were followed timely to raise a good crop. Observations were recorded on different morphological characters and seed yield per plant. Five plants were randomly selected and tagged from each plot before flowering to record on quantitative as well as qualitative parameters like Plant height, number of branches, numbers of umbels per plant, number of umbellets per umbel, seed yield per plant, number of seeds per umbel, number of seeds per umbellets, test weight, oil content, days to 1st flowering, days to 50% flowering, days to maturity, germination percentage, seed yield per plot. These quantitative characters were used to estimate phenotypic and genotypic coefficient of variation, heritability, expected genetic advance at 5 per cent selection intensity following the standard statistical methods (Singh and Choudhary, 1979). Analysis of variance was performed following the standard procedure given by Panse and Sukhatme (1967). The phenotypic and genotypic coefficients of variation (PCV, GCV) were computed as per method described by Burton and Devane (1953). Heritability in broad sense and genetic advance (% of mean) were calculated as per Allard (1960).

Results and Discussion

The analysis of variance revealed that significant amount of variability was present in all genotypes for almost all morphological traits studied (Plant height, number of branches, numbers of umbels per plant, number of umbellets per umbel, seed yield per plant, number of seeds per umbel, number of seeds per umbellets, test weight, oil content, days to 1st flowering, days to 50% flowering, days to maturity, germination percentage, seed yield per plot). The mean sum of squares for fourteen characters in sixteen genotypes and one check variety of dill genotypes were presented in Table 1.

High range was observed for plant height, seed yield per plant, no. of seeds per umbel, days to 1st flowering, days to 50 % flowering, germination percentage and seed yield per plot (Table 2).

A variation for these characters is found to be quite high which might be responsible for the wide range in yield potential of different genotypes. A wide range of variation existing for various quantitative traits has also been reported in Dill by Meena *et al.,* (2017) and Nandkumar *et al.,* (2018). The maximum seed yield per plot (362.00 g) was recorded in the AKDIL-13, while the minimum seed

yield per plot was recorded in AKDIL-07 (40.00 g). Six genotypes recorded significantly more seed yield per plot when compared to grand mean. The genotype AKDIL-02, AKDIL-04 and AKDIL-05 were recorded the maximum values for seed yield per plant, number of umbellets per umbel, number of seeds per umbel and number of seeds per umbellets. Similar pattern of variability in germplasm evaluation of different sizes for various traits in Dill have earlier been reported by Yadav *et al.,* (2017) and Jyothi *et al.,* (2017).

Higher GCV (Genotypic coefficient of variation) was recorded for seed yield per plot (48.18), seed yield per plant (24.89), Number of seeds per umbel (23.68), test weight (11.10), and number of branches (10.74).

Similarly, Higher PCV (phenotypic coefficient of variation) was recorded for the seed yield per plot (49.64), seed yield per plant (25.48), Number of seeds per umbel (24.95), number of seeds per umbellets (14.93), oil content (11.42), test weight (11.14), and number of branches (12.36) (Table 2). Similar findings were reported by Yogi *et al.,* (2013), Jyothi *et al.,* (2017), Yadav *et al.,* (2017) and Nandkumar *et al.,* (2018).

While, the moderate to high values of GCV and PCV were recorded for number of seeds per umbel (23.67% and 24.95%) and seed yield per plant (24.88% and 25.48%), respectively.

Moderate values observed for number of branches (10.73% and 12.36%), test weight (11.09% and 11.13%) indicated that, predominance of additive gene action in the inheritance of this character revealing like hood of favorable response to selection by this character. Wide difference between PCV and GCV for yield implies its susceptibility to environmental fluctuation, whereas narrow difference suggested their relative resistance to environmental alteration is presented in table 2.

Character showing high heritability *viz*., test weight (99.32%), seed yield per plant (95.36%), seed yield per plot (94.20%), number of seeds per umbel (90.05%), germination percentage (78.68%) and number of branches (75.44%).

Similar results were found in findings of Meena *et al.,* (2014) in coriander under Akola conditions and Meena and Dhakar (2017).

This has extended the hope for reliability of selection in the present material studied. Since, it is broad sense heritability a caution has to be exercised for its direct application while making the selection.

The results indicated that, the expected genetic advance over mean observed was in the range of 2.39% to 96.32% for different characters. The highest percent of expected genetic advance to the extent of 96.32% was noted for the character seed yield per plot which was followed by seed yield per plant (50.06%) and number of seeds per umbel (46.29%).

The moderate values were recorded for the characters of test weight (22.78%), number of branches (19.21%), germination percentage (17.69%), oil content (15.49%), plant height (12.97%) and number of seeds per umbellets (11.37%). Similar results were reported by Rajput and Singh (2003). These results observed with high values for expected genetic advance accompanied with high heritability estimates are indicative of the fact that, the improvement could be effectively realized through selection in these characters on phenotypic values.

High heritability coupled with high genetic

advanced observed for seed yield per plot, seed yield per plant and number of seeds per umbel indicated that, these characters were governed largely through the additive gene effect and improvement of these characters may be achieved through phenotypic selection.

Table.1 Analysis of variance for different characters of dill

Characters	Replication (2)	Treatment (16)	Error (32)
Plant height	5.353	386.061**	52.999
Number of branches	0.217	1.181**	0.116
Numbers of umbels per plant	0.551	0.491**	0.186
Number of umbellets per umbel	0.236	1.421**	0.536
Seed yield per plant	0.01	15.79**	0.252
Number of seeds per umbel	825.961	10,739.30**	381.315
Number of seeds per umbellets	6.725	6.713**	2.434
Test weight	0	0.355*	0.001
Oil content	0.018	1.96*	0.289
Days to 1st flowering	30.353	34.478**	13.103
Days to 50% flowering	23.529	19.865**	7.509
Days to maturity	0.235	39.664**	14.881
Germination percentage	56.137	229.505*	19.012
Seed yield per plot	287.137	19,840.07**	399.158

*,** significant at 5% and 1% level, respectively
( ) value in parentheses indicates degree of freedom

Table.2 Estimates of genotypic coefficient of variation, phenotypic coefficient of variation, heritability, genetic advance for different characters in dill

Character	Range	Mean	PCV (%)	GCV (%)	Heritability (h^2) %	Genetic advance	EGA as % over mean
Plant height	107.33 - 153.33	137.65	9.30	7.65	67.69	17.86	12.97
Number of branches	3.67 - 6.40	5.55	12.36	10.74	75.44	1.07	19.21
Numbers of umbels per plant	5.00 - 6.53	5.85	9.17	5.46	35.41	0.39	6.69
Number of umbellets per umbel	16.83 -19.67	18.20	5.01	2.98	35.51	0.67	3.66
Seed yield per plant	6.03 -14.07	9.14	25.48	24.89	95.36	4.58	50.06
Number of seeds per umbel	96.00 - 344.33	248.16	24.95	23.68	90.05	114.87	46.29
Number of seeds per umbellets	9.00 - 14.67	13.16	14.93	9.08	36.95	1.50	11.37
Test weight	2.29 - 3.46	3.09	11.14	11.10	99.32	0.70	22.78
Oil content	6.60 - 9.67	8.05	11.42	9.27	65.87	1.25	15.49
Days to 1st flowering	62.67 - 74.67	67.35	6.68	3.96	35.22	3.26	4.84
Days to 50% flowering	71.00 - 82.33	75.23	4.53	2.70	35.42	2.49	3.31
Days to maturity	143.00 -156.00	147.88	3.25	1.94	35.70	3.54	2.39
Germination percentage	96.33 - 71.67	86.51	10.92	9.68	78.68	15.31	17.69
Seed yield per plot	40.00 – 362.00	167.10	49.64	48.18	94.20	160.95	96.32

The differences between PCV and GCV for many characters such as seed yield per plot, seed yield per plant, number of seeds per umbel, test weight and germination percentage were found minimum indicating less environmental effect. Based on direct and indirect effects of different yield components on seed yield, it appears that, more stress on plant height at harvesting, number of branches per plant, number of umbels per plant, number of umbellets per umbel, number of seeds per umbel, number of seeds per umbellets and germination percentage will be useful in identifying the dill genotypes as parents for further improvement. On the basis of performance of all genotypes under studied in respect to, yield and yield contributing characters, the genotypes AKDIL-02, AKDIL-04, AKDIL-05 and AKDIL-13 were found promising for future improvement programme.

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