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Studies on heritability (Narrow Sense) and genetic advance analysis for growth, yield and quality traits in cucumber (*Cucumis sativus* L.)

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Abstract

The present study was undertaken on cucumber in a Line x tester was undertaken with the study of combining ability variances and their effect. The 36 F₁ hybrid along with their twelve line and three testers were crossed in line x tester fashion to obtained 36 F₁ and evaluated in randomized block design in three replications having each experimental unit of single row with spacing of 2.5 m x 0.5 m at Vegetable Research Farm, Kalyanpur, C. S. Azad University of Agriculture and Technology, Kanpur during zaid and summer - 2018-19. The selected parental lines are consisted 12 lines (No.-100, No.-512, No.- 40, No.-1, 5- URC-11-1, Panjab Naveen, Pusa Barkha, Poinsett-76, Pahari Barsati, Poinsett, Swarn Ageti, Pusa Uday with 3 testers (PCUC-8, Swarna Poona and Boro Patana). Observations were recorded on all the six plants maintained for 20 metric traits viz. day to first male flower initiation day to first female flower initiation, number of node for first male flower, number of node for first female flower, number of branches per plant, vine of length @ 60DAS, number of fruit per plant, day to first fruit set, number of fruit per vine @ 60 DAS, length of fruit (cm.), number of node/wine, duration of crop average weight of fruit diameter of fruit, fruit yield (kg./plant), day to first fruit picking, T.S.S, specific gravity of fruit, dry matter (%). The estimates of high heritability observed in narrow sense days to first female flower initiation followed by Average weight of fruit (kg.) and Number of node for 1st female flower in E1, E2 and pooled, Genetic advance in per cent of mean was maximum for Number of branches per plant (59.69%) followed by number of fruits per plant (44.88%), Length of fruit (43.13%), in E1, E2 and pooled.

Keywords: Heritability, narrow sense, genetic advance

Introduction

Cucumber (*Cucumis sativus* L.) is a member of the family Cucurbitaceae, The crop is grown throughout the world, is the second most widely cultivated cucurbit after watermelon and ranks fourth among the economic vegetables in Asia after tomato, onion and cabbage (Tatlioglu, 1993) [7]. Cucumber is nutritionally very rich in vitamins and minerals. In India, it is cultivated in an area of 0.26 lakh hectares with an annual production of 1.65 lakh metric tonnes, whereas the world area is 2.44 million hectares with a production of 80.61 million metric tonnes cucumber is grown throughout the world in large commercial farms, glasshouses and small gardens. It is a low energy and high water content vegetable. Its fruits are eaten at immature stage as refreshing salad vegetable and are said to have cooling effect, prevent constipation and are useful to jaundice patients. The fruit is also used as an astringent and antipyretic. The heritability provides index of transmissibility of characters. Heritability is the ratio of variation due to differences between genotypes to the total phenotypic variation for a trait in a population and shows the component of a character transmitted to future generations. Genetic advance shows the difference between the mean genotypic values of selected population and the original population from which these were selected. Heritability estimates along with genetic advance is more precise in predicting the genetic gain under selection. Variability, genetic diversity, expected genetic advances and heritability of the traits are key basis for genetic improvement of the trait (Adhikari *et al.*, 2018b) [1].

Material and Methods

The experiment entitled “Line x tester analysis for yield and quality traits in cucumber (*Cucumis sativus* L.)” was undertaken with the objectives (i) To estimate genetic variability, heritability and genetic advance for different characters (ii) to find out nature and magnitude of

gene action involve in the inheritance of various characters (iii) To estimate combining ability variances and their effect and (iv) To work out heterosis extent for different characters for planning of an appropriate strategy for development of high yielding cucumber hybrid as well as breeding procedure. The materials of experiment consisted 12 lines (No-100, No.-512, No.- 40, No.-1, 5- URC-11-1, Punjab Naveen, Pusa Barkha, Poinsett-76, Pahari Barsati, Poinsett, Swarn Ageti, Pusa Uday with 3 testers (PCUC-8, Swarna Poona and Boro Patana) were crossed in line x tester fashion to obtained 36 F₁ and evaluated in randomized block design in three replications having each experimental unit of single row with spacing of 2.5 m x 0.5 m at Vegetable Research Farm, Kalyanpur, C. S. Azad University of Agriculture and Technology, Kanpur during zaid and summer - 2018-19. Observations were recorded on all the six plants maintained for 20 metric traits viz. day to first male flower initiation day to first female flower initiation, number of node for first male flower, number of node for first female flower, number of branches per plant, vine of length @ 60DAS, number of fruit per plant, day to first fruit set, number of fruit per vine @ 60DAS, length of fruit (cm.), number of node/wine, duration of crop average weight of fruit diameter of fruit, fruit yield (kg./plant, day to first fruit picking, T.S.S, specific gravity of fruit, dry matter (%). Heritability in narrow sense (h²ns) was-calculated as suggested by Kempthorne (1957) [6]. Expected genetic advance (Ga) was estimated by the formula suggested by Johnson *et al.* (1955).

Result and Discussion

The estimates of heritability in narrow sense ranged from 47.04 per cent (days to first female flower initiation) to 10.70 per cent (days to first fruit set) in E1, 46.59 per cent (days to first female flower initiation) to 10.05 per cent (days to first

fruit set) while in over season pooled estimates of heritability in narrow sense ranged from 53.20 per cent (days to first female flower initiation) to 11.28 per cent in (T.S.S.).

The estimates of heritability in broad sense (h²bs) ranged from 98.49 (Length of fruit) to 47.05 per cent (Day to first male flower initiation) in E1, 97.31 per cent (Length of fruit) to 45.90 per cent (Fruit yield (kg./plant) in E2 and heritability in broad sense (h²bs) over season pooled ranged from 98.03 per cent (Length of fruit) to 55.19 per cent (Day to first male flower initiation). Higher estimates of heritability (>70.00%) were observed for all the character except Day to first female flower initiation (64.46) in E1, Day to first female flower initiation, Vine of length @ 60DAS, Diameter of fruit, Fruit yield (kg./plant, Specific gravity of fruit in E2 which show the moderate heritability and in over season pooled Day to first male flower initiation, Day to first female flower initiation, Fruit yield (kg./plant show the moderate heritability show the moderate heritability.

Genetic advance

Genetic advance (Ga) and genetic advance in per cent of mean (Gs%) were estimated for all characters and are presented in Table 4.2.

Genetic advance in per cent of mean was maximum for Number of branches per plant (59.69%) followed by number of fruits per plant (44.88%), Length of fruit (43.13%), Vine of length @ 60DAS (37.06%) in E1 and in season E2 Number of branches per plant (54.24) followed by Length of fruit (40.53), Average weight of fruit (39.18), Number of fruit per plant (37.29), Number of node for 1st female flower (34.34) whereas, in over season pooled genetic advance in per cent of mean was maximum for Number of branches per plant (57.17) followed by average weight of fruit (42.42), Number of fruit per plant (40.79) and Length of fruit (41.88).

Table 1: Estimates of heritability and genetic advance for 19 characters in cucumber

Sr. No.	Characters	E ₁				E ₂			
		Heritability in narrow scence (h ² ns)	Heritability in broad scence (h ² bs)	Genetic advance	Genetic advance in percent of mean	Heritability in narrow scence (h ² ns)	Heritability in broad scence (h ² bs)	Genetic advance	Genetic advance in percent of mean
1.	Day to first male flower initiation	27.82	47.05	2.44	6.19	46.59	61.47	3.77	9.53
2.	Day to first female flower initiation	47.04	64.66	3.39	8.33	46.59	65.27	4.21	10.09
3.	Number of node for first male flower	17.19	85.20	1.95	31.77	14.99	82.35	2.12	33.57
4.	Number of node for 1 st female flower	28.66	94.42	3.15	35.97	28.20	94.88	3.04	34.34
5.	Number of branches per plant	19.84	97.46	2.24	59.69	18.92	95.11	2.11	54.24
6.	Vine of length @ 60DAS	25.23	87.48	0.72	37.06	25.46	69.39	0.68	33.48
7.	Number of fruit per plant	20.12	97.15	4.85	44.88	15.75	88.06	4.17	37.29
8.	Day to first fruit set	10.70	88.34	7.07	15.47	10.05	82.42	6.37	14.22
9.	Number of fruit per vine @ 60DAS	33.37	90.73	1.25	27.83	28.54	80.08	1.17	25.18
10.	Length of fruit (cm.)	18.23	98.49	6.91	43.13	18.04	97.31	6.57	40.53
11.	Number of node/wine	26.15	97.66	6.70	33.72	26.40	96.70	6.23	31.22
12.	Diameter of fruit (cm.)	32.73	89.65	0.99	21.22	10.50	59.79	0.64	13.46
13.	Average weight of fruit (kg.)	42.39	98.25	86.1	47.07	38.90	92.74	73.50	39.18
14.	Duration of crop (days)	15.96	77.90	8.49	8.73	14.49	76.79	8.03	8.16
15.	Fruit yield (kg./plant)	42.14	80.39	0.39	26.72	40.27	45.90	0.25	15.50
16.	Day to first fruit picking	12.28	86.51	7.31	13.89	13.16	80.16	6.47	12.56
17.	T.S.S	11.30	93.61	0.93	33.97	11.18	82.51	0.85	28.72
18.	Specific gravity of fruit	13.49	77.85	0.12	16.44	14.19	69.63	0.10	13.42
19.	Dry matter	37.96	95.53	0.93	22.93	38.94	81.19	0.84	20.05

Cont.....

Sr. No.	Characters	Pooled			
		Heritability in narrow sense (h^2_{ns})	Heritability in broad sense (h^2_{bs})	Genetic advance	Genetic advance in per cent of mean
1.	Day to first male flower initiation	34.61	55.19	3.13	7.93
2.	Day to first female flower initiation	53.20	68.90	4.05	9.82
3.	Number of node for first male flower	17.45	85.26	2.08	33.34
4.	Number of node for 1 st female flower	28.97	95.17	3.11	35.35
5.	Number of branches per plant	19.58	96.71	2.18	57.17
6.	Vine of length @ 60DAS	26.63	76.05	0.69	34.61
7.	Number of fruit per plant	18.28	92.16	4.49	40.79
8.	Day to first fruit set	11.19	87.26	6.86	15.17
9.	Number of fruit per vine @ 60DAS	33.46	86.81	1.24	26.99
10.	Length of fruit (cm.)	18.41	98.03	6.75	41.88
11.	Number of node/wine	26.58	95.46	6.35	31.90
12.	Diameter of fruit (cm.)	22.48	73.69	0.83	17.01
13.	Average weight of fruit (kg.)	40.82	94.05	73.69	42.42
14.	Duration of crop (days)	17.08	80.94	8.64	8.84
15.	Fruit yield (kg./plant)	46.10	65.17	0.33	21.87
16.	Day to first fruit picking	13.65	85.69	7.08	13.60
17.	T.S.S	11.28	86.66	0.88	30.79
18.	Specific gravity	14.96	76.57	12.20	15.46
19.	Dry matter	39.08	88.95	0.89	21.68

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