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CHARACTERIZATION OF EARLY CAULIFLOWER GERMPLASM UNDER TROPICAL CONDITIONS

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ABSTRACT

The present investigation was undertaken to morphologically characterize the 51 genotypes of cauliflower for various horticultural characters. Out of 51 early cauliflower genotypes characterized, high coefficient of variation (C.V) was observed for yield characters like, gross curd weight (26.03 %), net curd weight (26.02 %) followed by curd size index (24.95 %) suggesting that these traits should be given top priority during selection programme. Genotypes *viz*., IIHR-272, IIHR-263, IIHR-266 and IIHR-390 showed superior performance for above parameters, hence these lines may be directly used for cultivation or as a source of desirable traits in a breeding programme for the improvement of curd yield and quality in cauliflower.

INTRODUCTION

Cauliflower (*Brassica oleracea* var. *botrytis* L.) is one of the important vegetable crops, grown throughout the year in different agro-climatic zones (Kaushal and Kaushal, 2013**).**

It is mainly grown for its curds which are rich in vitamin-C (ascorbic acid) and protein. Cauliflower is low in fat, but high in dietary fiber, foliate and water, possessing a high nutritional density. It contains several phytochemicals, common in the cabbage family that may be beneficial to human health. Sulforaphane, a compound released when cauliflower is chopped or chewed, may protect against cancer. Other glucosinolates, Carotenoids, Indole-3-carbinol, a chemical that enhances DNA repair and acts as an estrogen antagonist, slowing the growth of cancer cells. A high intake of cauliflower has been associated with reduced risk of aggressive prostate cancer (Kushwaha *et al.,* 2013).

During the course of cultivation in India, cauliflower has undergone significant changes in its morphological characters and adoptability to warm and humid weather due to continuous selection and acclimatization. As a result, Indian cauliflowers today constitute a separate group both in morphologically and genetically from the temperate types (Swarup and Chatterjee, 1972).

Agronomic traits such as curd yield and its components are major selection criteria for increasing its productivity (Yanglem and Tumbare, 2014).The morphological characters of a crop although subjected to variation through environmental influences, are undoubtedly the best indicators of yield and their correlation with yield. Therefore, they have received a great attention. The plant growth habit of the cultivars varies and exhibit a wide variation, which are unique and distinct. These morphological traits are useful in varietal identification and genetic purity testing.

The data base of cauliflower genotypes generated by morphological characterization may be useful for the selection of suitable varieties to be compared against the candidate varieties developed in India as and when required. This investigation may also be helpful to the researchers with respect to breeding of cauliflower varieties for particular traits. Moreover, farmers can also get benefit with regards to selection of suitable varieties of their interest (Singh *et al*., 2013).

Many tools are now available to study relationships among genotypes, including various types of molecular markers; however, morphological characterization is the first step in the description and classification of germplasm (Smith and Smith, 1989). Keeping these points in view, morphological characterization was carried out to identify the superior cauliflower genotypes.

MATERIALS AND METHODS

The present experiment was conducted at the vegetable farm, Indian Institute of Horticultural Research (IIHR), Hessaraghatta, Bengalore. Experimental material used in the present study comprised of 51 genotypes of early cauliflower (*Brassica oleracea* var. *botrytis* L.), maintained in the Division of Vegetable Crops, IIHR, Bengalore. Experiment was laid out in a randomised complete block design with two replications. The sowing of all genotypes was done in nursery bed and 23 days old seedlings were transplanted at the spacing of 50 cm between rows and 40cm between plants within the rows. Sixty

plants were maintained in each genotype per replication. The package of practices to raise a successful crop of cauliflower was followed.

Collection and characterization of the existing variability is the first step a *priori* to any breeding programme. In the present study, 51 diverse genotypes of early cauliflower were characterized for different qualitative and quantitative parameters as per the NBPGR minimal descriptor for cauliflower (Anon., 2009). The genotypes were grouped into different categories based on the variations present within the parameter. Morphological characterization has been done based on characters like, plant growth habit, leaf shape, leaf glossiness, number of leaves, leaf colour, leaf length, leaf width, days to 50% curd initiation, days to 50% curd maturity, curd maturity duration, curd shape, curd colour, curd compactness, curd length, curd breadth, curd size index, gross curd weight, marketable curd weight, net curd weight, stalk length, harvest index, physiological disorder, 1000 seed weight, bolting habit and biotic stress susceptibility. The genotypes were categorized into different groups which are discussed here under (Table 1). Mean data were subjected to statistical analysis to calculate range, standard deviation and coefficient of variability and these were used to group germplasm into different categories.

RESULTS AND DISCUSSION

Though knowledge about the extent of variability present in the population is essential for launching any breeding programme in the crop improvement, the success of such programme depends largely on the available genetic variability in the given species.

In early cauliflower the plant characters like, growth habit, days taken for 50% curd initiation and maturity, leaf number and curd quality parameters play an important role in the selection of superior genotypes. Further curd yield and its attributes in early cauliflower are the most important characters deciding the superiority of the genotypes.

Much variation has been observed in most of the characters studied. This variability could be attributed to the different eco-geographical back ground to which they have been exposed and the operation of natural and human selection. Kumar and Korla (2001), Shakuntla and Kalia (2005), Sharma *et al*. (2006), Quamruzzaman *et al*. (2007), Singh *et al*. (2010) and Mehra and Singh (2013) reported similar results in cauliflower.

A wide range of variability was observed among the genotypes for number of leaves (11.4-19.3), leaf length (20.3-37.6 cm), leaf width (10.8-19.1cm), days to 50% curd initiation (36-47 days), days to 50% curd maturity (48-58.5), curd maturity duration (10-20 days), curd length (3.3-7 cm), curd breadth (4.8-10.3 cm), curd size index (16.6-54.3 cm^2), gross curd weight (256-816 g), marketable curd weight (147.5-464.5 g), net curd weight (70.4-250.7g), stalk length (2.6-5.2 cm), harvest index (19.4-38.9%), riceyness (0-5%) and 1000 seed weight (1.9-5.2 g) indicating the scope for selection of suitable initial material for breeding, in the improvement of early cauliflower (Table 2). High coefficient of variation (C.V) was observed for yield characters like, gross curd weight (26.03 %) followed by net curd weight (26.02 %) and curd size index (24.95 %). Kumar *et al*. (2010) found significant differences among the genotypes in Indian cauliflower suggesting sufficient variability for yield and quality characters.

In general, semi spreading type of plant growth habit is preferred in early cauliflower as it is going to protect the curd from sunlight, thereby preventing the discoloration of the curd towards yellowing which may not be preferred in market. The pigments responsible for colour and the decrease in marketability of cauliflower curds appear to be flavonoids formed in response to exposure of the growing curd to sunlight (Thomas and Turner, 1992). In the present study almost 38 genotypes have recorded semi spreading type of plant growth habit which is desirable parameter in early group cauliflowers. Whereas, erect type by 4 genotypes and spreading type by 9 genotypes.

Earliness, uniform maturity and short curd maturity duration in early cauliflower are preferred as the genotypes with these parameters are the best suited for early market fetching higher prices. IIHR-217-1-4 was the earliest (36 days for 50% curd

Table 1: Grouping of 51 early cauliflower germplasm with respect to qualitative parameters

Sl.No.	Characters	Category	
1	Plant growth habit	a.	Erect (4)
		b.	Semi spreading (38)
		c.	Spreading (9)
2	Leaf shape	a.	Narrow (7)
		b.	Intermediate (29)
		c.	Broad (15)
3	Leaf glossiness	a.	Present (51)
4	Leaf colour	a.	Green (13)
		b.	Dark green (38)
5	Curd shape	a.	Flat (6)
		b.	Round (45)
6	Curd colour	a.	Snow white (8)
		b.	White (15)
		c.	Cream (25)
		d.	Yellow (3)
7	Curd compactness	a.	Loose (9)
		b.	Medium compact (20)
		c.	Compact (13)
		d.	Very compact (9)
8	Bolting habit	a.	Tropical (50)
9	Biotic stress susceptibility		
a.	Downy mildew	a.	Very low (32)
		b.	Low (18)
		c.	Intermediate (1)
b.	Black rot	a.	Very low (48)
		b.	Low (1)
		c.	Intermediate (2)
c.	*Alternaria* leaf spot	a.	Very low (35)
		b.	Low (15)
		c.	Intermediate (1)
d.	Leaf hopper	a.	Very low (35)
		b.	Low (14)
		c.	Intermediate (2)
e.	Diamond back moth	a.	Very low (43)
		b.	Low (8)
f.	Aphid	a.	Very low (48)
		b.	Low (3)

Table 2: Characterization of 51 genotypes of early cauliflower.

Sl.No.	Genotypes	Number of leaves	Leaf length (cm)	Leaf width (cm)	Days to 50% curd initiation	Days to 50% curd maturity	Curd maturity duration (days)	Curd length (cm)	Curd breadth (cm)
1	IIHR-73	14.1	28.6	13.0	38.5	58.5	20.0	3.4	4.9
2	IIHR-78-7	14.1	29.9	14.4	40.5	56.0	15.5	4.7	9.3
3	IIHR-214-5	11.8	35.2	15.5	43.0	58.0	15.0	4.0	4.8
4	IIHR-217-1-4	14.3	27.0	13.8	36.0	48.0	12.0	5.4	8.9
5	IIHR-223-10	17.9	32.6	16.8	42.0	57.0	15.0	4.8	8.6
6	IIHR-231-4	17.2	32.7	14.7	47.0	57.0	10.0	4.1	6.6
7	IIHR-249	17.4	31.7	13.6	37.0	52.0	15.0	4.8	8.7
8	IIHR-249-5	17.5	27.4	11.5	39.0	50.0	11.0	4.9	9.9
9	IIHR-250	15.8	31.5	14.1	36.5	53.0	16.5	4.2	8.2
10	IIHR-263	18.1	33.5	17.2	38.5	56.0	17.5	4.9	10.3
11	IIHR-264-3	17.4	30.9	15.7	37.0	53.0	16.0	4.8	9.0
12	IIHR-265-2	17.1	34.8	16.0	44.0	58.0	14.0	4.6	9.3
13	IIHR-266	18.4	37.2	18.5	40.5	54.0	13.5	4.2	8.9
14	IIHR-272	19.3	34.2	17.5	38.0	56.0	18.0	4.7	9.8
15	IIHR-277-14	17.5	35.7	16.2	39.0	58.0	19.0	4.3	7.1
16	IIHR-305	15.5	29.0	14.7	38.0	52.0	14.0	4.8	9.1
17	IIHR-311-3	14.1	32.4	15.1	37.0	53.0	16.0	5.6	9.6
18	IIHR-316	16.0	32.0	13. 5	37.5	54.0	16.5	4.7	9.5
19	IIHR-318-2	14.9	33.0	15.0	42.0	56.0	14.0	4.4	7.9
20	IIHR-323-13	16.3	35.1	17.3	40.5	58.0	17.5	4.1	7.1
21	IIHR-324-1-5	17.3	37.6	16.3	42.0	55.0	13.0	4.6	8.1
22	IIHR-343-1	17.3	32.9	13.9	40.5	56.0	15.5	5.0	10.0
23	IIHR-345	14.7	33.9	15.1	42.0	56.0	14.0	5.0	7.8
24	IIHR-352	17.8	33.2	15.4	42.0	58.0	16.0	7.0	6.9
25	IIHR-368	14.2	32.2	17.9	40.5	56.0	15.5	5.8	7.1
26	IIHR-369	14.6	27.9	13.0	40.5	56.0	15.5	3.5	5.5
27	IIHR-370	14.8	32.5	16.0	38.0	53.0	15.0	4.3	8.3
28	IIHR-371	12.8	20.3	10.8	38.0	56.0	18.0	3.6	5.7
29	IIHR-372	14.3	28.4	15.0	39.0	54.0	15.0	4.0	7.4
30	IIHR-373	15.3	32.7	19.1	38.0	52.0	14.0	4.8	9.8
31	IIHR-374	15.5	26.8	15.3	38.5	54.0	15.5	4.6	8.8
32	IIHR-375	15.7	33.7	17.1	38.0	54.0	16.0	4.8	9.9
33	IIHR-376	11.7	24.3	12.4	38.0	54.0	16.0	3.3	6.1
34	IIHR-377	11.4	22.8	11.9	37.0	56.0	19.0	3.6	6.8
35	IIHR-378	14.4	27.3	13.0	38.0	53.0	15.0	4.9	9.5
36	IIHR-379	14.2	32.5	16.3	42.0	57.0	15.0	4.1	6.9
37	IIHR-380	15.1	32.3	16.2	38.0	54.0	16.0	4.1	9.2
38	IIHR-381	14.0	27.5	13.2	36.5	54.0	17.5	4.2	7.6
39	IIHR-382	14.1	31.8	16.1	36.5	52.0	15.5	4.6	10.0
40	IIHR-383	12.8	26.5	14.1	40.5	58.0	17.5	4.1	8.7
41	IIHR-384	14.9	31.6	15.2	39.5	54.0	14.5	5.2	9.5
42	IIHR-385	15.9	30.0	16.1	40.5	55.0	14.5	4.2	8.5
43	IIHR-386	14.9	29.3	15.3	38.5	55.0	16.5	4.3	9.1
44	IIHR-387	14.8	32.2	14.4	39.5	57.0	17.5	4.7	9.7
45	IIHR-388	13.5	31.6	15.9	38.0	54.0	16.0	4.3	8.5
46	IIHR-389	15.7	30.6	14.4	39.0	52.0	13.0	4.5	8.9
47	IIHR-390	16.1	31.8	17.7	37.0	53.0	16.0	4.7	9.9
48	IIHR-391	15.0	31.5	14.6	40.5	56.0	15.5	4.4	8.2
49	IIHR-392	13.5	25.2	11.9	38.0	58.0	20.0	3.4	6.3
50	Early Kunwari	17.2	34.6	16.1	37.5	55.0	17.5	4.3	7.8
51	NS-60	18.3	36.5	18.4	44.0	57.0	13.0	4.5	9.2
	Range	11.4-19.3	20.3-37.6	10.8-19.1	36-47	48-58.5	10-20	3.3-7	4.8-10.3
	Mean	15.42	31.11	15.17	39.35	54.93	15.58	4.51	8.30
	S.E±	1.84	3.60	1.87	2.29	2.28	2.03	0.64	1.41
	C.V%	11.92	11.57	12.32	5.82	4.14	13.05	14.23	17.02

initiation) and curd maturity duration was only 12 days which is suitable for early market. Highest numbers of leaves were observed in the genotypes like, IIHR-272 (19.3) and IIHR-266 (18.4). Since number of leaves an important character contributing towards increased photosynthesis there by resulting in increased curd weight, these genotypes may be utilized for improvement of curd yield in early cauliflower (Chatterjee and Swarup, 1972).

In the present study leaf shape ranged from narrow (7), intermediate (29) and broad (15) and all most all the genotypes

Table 2: Cont.....

Sl.No.	Genotypes	Curd size index (cm^2)	Gross curd weight (g)	Marketable curd weight (g)	Net curd weight (g)	Stalk length (cm)	Harvest index (%)	Riceyness (%)	1000 seed weight (g)
1	IIHR-73	16.6	292.4	154.0	70.4	2.6	22.7	0	3.2
2	IIHR-78-7	46.3	585.5	374.0	211.0	3.1	35.9	0	4.0
3	IIHR-214-5	19.8	271.3	246.3	98.8	3.2	26.8	3	4.7
4	IIHR-217-1-4	45.7	540.5	319.0	190.5	3.9	35.3	1	3.5
5	IIHR-223-10	42.2	704.3	367.3	184.0	2.8	26.1	2	5.2
6	IIHR-231-4	27.2	494.5	258.5	121.5	2.6	24.7	0	3.7
7	IIHR-249	41.0	677.9	355.4	196.8	2.9	29.0	2	3.0
8	IIHR-249-5	48.9	762.1	415.0	217.9	3.8	19.4	0	3.6
9	IIHR-250	34.3	466.3	266.0	154.0	5.2	33.0	0	3.8
10	IIHR-263	53.6	788.5	459.8	232.3	3.1	30.3	0	3.6
11	IIHR-264-3	41.8	685.0	377.5	201.0	3.6	29.4	0	4.1
12	IIHR-265-2	45.9	641.0	377.3	189.0	3.2	28.9	0	3.3
13	IIHR-266	39.1	766.3	422.0	207.0	2.8	27.0	0	4.5
14	IIHR-272	47.8	816.0	464.5	239.0	3.6	29.3	1	4.5
15	IIHR-277-14	33.1	545.0	276.8	128.5	3.1	23.6	2	3.6
16	IIHR-305	44.6	633.8	391.8	183.0	3.2	28.7	1	4.3
17	IIHR-311-3	54.3	747.0	419.0	226.5	4.1	30.3	3	4.0
18	IIHR-316	46.6	675.3	389.5	216.3	3.6	32.2	0	4.0
19	IIHR-318-2	35.7	553.5	313.0	146.0	3.6	26.4	1	4.6
20	IIHR-323-13	30.6	545.0	292.3	151.0	3.4	27.8	0	4.9
21	IIHR-324-1-5	39.2	711.3	395.0	203.5	3.3	28.9	1	3.3
22	IIHR-343-1	52.0	635.0	376.0	188.5	3.3	29.9	0	3.4
23	IIHR-345	42.4	499.5	302.8	164.0	3.4	32.6	3	3.9
24	IIHR-352	29.3	579.5	298.3	148.0	2.7	25.4	2	4.3
25	IIHR-368	44.0	512.5	302.1	165.9	3.0	33.3	0	4.3
26	IIHR-369	20.7	293.3	249.8	75.0	2.7	22.9	0	3.9
27	IIHR-370	36.8	533.2	317.8	180.7	2.6	33.3	0	4.2
28	IIHR-371	23.2	256.0	147.5	81.0	2.8	31.9	1.5	4.3
29	IIHR-372	29.7	534.7	308.9	181.9	3.7	34.2	0	3.4
30	IIHR-373	48.4	665.5	409.0	250.7	3.3	34.1	0	4.2
31	IIHR-374	40.2	522.5	306.3	201.3	3.2	38.9	0	4.7
32	IIHR-375	47.7	616.3	360.4	195.4	3.5	32.0	0	4.1
33	IIHR-376	20.2	301.0	178.7	105.0	3.6	29.1	0	1.9
34	IIHR-377	24.6	287.2	176.8	103.5	3.8	35.9	0	3.7
35	IIHR-378	46.4	497.7	261.0	143.5	3.5	28.9	0	4.4
36	IIHR-379	28.3	472.3	262.5	137.3	2.9	29.0	0	3.6
37	IIHR-380	37.7	569.5	346.5	187.0	3.3	32.9	0	3.5
38	IIHR-381	32.6	472.8	283.5	138.0	3.4	28.9	0	4.4
39	IIHR-382	45.9	561.1	371.4	196.4	3.1	34.9	0	4.0
40	IIHR-383	37.1	358.0	234.0	132.0	3.1	37.0	0	4.2
41	IIHR-384	50.9	619.6	369.6	204.2	2.9	32.8	0	4.5
42	IIHR-385	37.1	609.4	346.9	175.4	3.8	28.3	0	4.4
43	IIHR-386	38.9	528.0	324.1	152.0	3.1	28.9	0	4.1
44	IIHR-387	48.0	565.0	330.0	203.3	3.5	36.1	0	4.1
45	IIHR-388	37.6	477.7	274.8	155.4	3.7	32.8	2	4.4
46	IIHR-389	40.1	509.6	302.1	177.5	2.9	34.9	0	4.8
47	IIHR-390	46.7	703.4	415.0	231.4	2.7	32.6	0	4.7
48	IIHR-391	36.9	542.8	301.3	173.3	3.8	31.3	0	4.4
49	IIHR-392	22.5	314.0	197.0	92.0	2.6	28.7	0	4.0
50	Early Kunwari	33.5	610.5	318.8	158.0	4.0	25.8	5	3.8
51	NS-60	42.7	778.0	406.3	207.5	3.0	26.6	0	-
	Range	16.6-54.3	256-816	147.5-464.5	70.4-250.7	2.6-5.2	19.4-38.9	0-5	1.9-5.2
	Mean	38.36	555.45	321.83	170.06	3.29	30.19	0.60	4.02
	S.E±	9.57	144.57	75.66	44.26	0.49	4.07	1.10	0.57
	C.V%	24.95	26.03	23.51	26.02	14.85	13.50	184.71	14.19

(51) had glossy dark green leaves. The glossyness of leaf being a recessive character may be useful as a marker in seedling stage. Besides, the glossy character is associated with higher vitamin-C content (Chatterjee and Swarup, 1972).

In general round, white and compact curds are preferred in the market. However, the early group of cauliflowers which comes to maturity during August to September grown under high temperature will produce cream to white coloured, medium compact curds. Because of their earliness even the cream coloured, medium compact to compact curds are

Table 3: Promising cauliflower lines identified for different quantitative traits.

Sl.No.	Character	Range	Germplasm Lines
1	Number of leaves	> 18	IIHR-272, 266, NS-60, 263
2	Leaf length (cm)	> 35 cm	IIHR-323-13, 214-5, 277-14, NS-60, 266, 324-1-5
3	Leaf width (cm)	>17 cm	IIHR-375, 263, 323-13, 272, 390, 368, NS-60, 266, 373
4	Days to 50% curd initiation	< 37 days	IIHR-217-1-4, 381, 250, 382
5	Days to 50% curd maturity	< 53 days	IIHR-217-1-4, 249-5, 382, 249, 305, 373, 389
6	Curd maturity duration (days)	< 13 days	IIHR-231-4, 249-5, 217-1-4, 389, 324-1-5, NS-60
7	Curd length (cm)	>5 cm	IIHR-384, 217-1-4, 311-3, 368, 352
8	Curd breadth (cm)	>9.5 cm	IIHR-311-3, 387, 272, 373, 390, 375, 249-5, 382, 343-1, 263
9	Curd size index (cm^2)	> 48 cm^2	IIHR-373, 249-5, 384, 343-1, 263, 311-3
10	Gross curd weight (g)	> 700 gm	IIHR-390, 223-10, 324-1-5, 311-3, 249-5, 266, NS-60, 263, 272
11	Marketable curd weight (g)	> 400 gm	NS-60, IIHR-373, 390, 249-5, 311-3, 266, 263, 272
12	Net curd weight (g)	>210 gm	IIHR-78-7, 316, 249-5, 311-3, 390, 263, 272, 373
13	Stalk length (cm)	< 2.7 cm	IIHR-73, 392, 231-4, 370
14	Harvest index (%)	> 35%	IIHR-217-1-4, 78-7, 377, 387, 383, 374
15	Riceyness (%)	>2%	IIHR-214-5, 311-3, 345, Early Kunwari
16	1000 seed weight (g)	>4.5 gm	IIHR-318-2, 390, 374, 214-5, 389, 323-13, 223-10

preferred in the market. In the present study majority of the genotypes have produced cream, medium compact to compact curds (IIHR-272, IIHR-249-5, IIHR-265-2, IIHR-264-3, IIHR-78-7, IIHR-375, IIHR-385, IIHR-386).

Generally, the shorter stem length is preferred for selection as it can withhold higher curd weight (Chatterjee and Swarup, 1972). In the present study the genotypes namely IIHR-73, IIHR-370, IIHR-231-4, and IIHR-392 have recorded shorter stalk length (< 2.6 cm). Hence, these genotypes can be utilized as a source for shorter stalk length in the breeding programmes. However some genotypes have recorded longer stalk length which may be a useful in the developing long stalk genotypes suitable for mechanical harvesting.

Gross curd weight, marketable curd weight and net curd weight were found to be highest in the genotypes namely, IIHR-272 (816 g, 464.5 g and 239 g respectively) and IIHR-263 (788.5 g, 459.8 g and 232.3 g respectively). Utilization of these genotypes for either direct cultivation or for the improvement of curd yield in early cauliflower may be desirable.

Most of the lines in the present study were free from the riceyness which is a desirable character. With regard to biotic stresses, early cauliflower is affected by downy mildew, black rot and *Alternaria* leaf spot diseases and pests like leaf hopper, diamond back moth and aphids. In the present study 51 genotypes of early cauliflower were screened against the pest and diseases under natural epiphytotic conditions. The results have indicated that susceptibility to downy mildew varied from very low (32 genotypes with scale 1) low (18 genotypes with scale 3) and intermediate (1genotype with scale 5) to downy mildew. For black rot 48 genotypes with scale 1 showed very low susceptibility, 1 genotype with scale 3 showed low susceptibility and 2 genotypes with scale 5 showed intermediate level of susceptibility and for *Alternaria* leaf spot 35 genotypes with scale 1 showed very low susceptibility, 15 genotypes with scale 3 showed low susceptibility and 1 genotype with scale 5 showed intermediate level of susceptibility. With regard to the insect incidence, genotypes have reported very low (35 genotypes), low (14 genotypes), intermediate (2 genotypes) for the incidence of leaf hopper, for diamond back moth very low (43 genotypes) low (8 genotypes) and for aphids very low (48 genotypes) and low (3 genotypes) incidence. All these resistant genotypes against the above pest and diseases need to be screened under artificial conditions before confirming there resistance for further use in the resistance breeding programme.

Promising entries identified for different important biometric traits are given in Table 3. These include lines with greater number of leaves, leaf length, leaf width, days to 50% curd initiation, days to 50% curd maturity, curd maturity duration, curd length, curd breadth, curd size index, gross curd weight, marketable curd weight, net curd weight, stalk length, harvest index, physiological disorder and 1000 seed weight. Some lines had more than one good character, for example, IIHR-263 and IIHR-266 had high marketable curd weight, gross curd weight, number of leaves with nil amount of riceyness. Likewise, 217-1-4 had taken lowest number of days for days to 50% curd initiation, maturity and curd maturity duration with highest harvest index.

A perusal of the results on the performance of the 51 genotypes of early cauliflower revealed that IIHR-272, IIHR-263, IIHR-266 and IIHR-390 were the superior genotypes due to their high yield, quality and disease resistance parameters. These lines can be either directly used for commercial cultivation or utilized in inter-varietal hybridization to obtain segregating populations.

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