

Evaluation of Okra [*Abelmoschus esculentus* (L.) Moench] Germplasm for Yield and Quality of Fruits

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One hundred and one accessions of okra [*Abelmoschus esculentus* (L.) Moench], collected from various parts of India were evaluated for yield and 11 yield attributes under field conditions at the Department of Plant Breeding and Genetics, College of Agriculture, Vellayani, Thiruvananthapuram, Kerala. The experiment was laid out in randomised block design with three replications and 10 plants/plot. The traits analysed were fruit yield [fruit weight/plant (g)] and yield attributes viz., fruits/plant, average fruit weight (g), fruit length (cm), fruit girth (cm), ridges/fruit, seeds/fruit, fruit colour, fruit pubescence, crude fibre content (%), protein content (g), mucilage content (%). ANOVA revealed remarkable variation for all the traits studied. Varsha Uphar, Parbhani Kranti and NBPGR/TCR-985 were the most promising genotypes identified during the investigation.

Key Words: *Abelmoschus esculentus*, Fruit yield, Okra, Variability, Yield components

Introduction

Vegetables, the important protective foods, are excellent sources of protein, vitamins, carbohydrate and minerals. Okra [*Abelmoschus esculentus* (L.) Moench] is an important vegetable of the world being produced in the tropical and sub-tropical low land regions of Asia, Africa, America and warmer parts of Mediterranean regions. As per Indian Horticulture database-2011, in India, okra is grown in an area of 4,98,000 ha and total production is 57,84,000 tons with a productivity of 11.6 t/ha. At global level, okra occupies an area of 11,47,950 ha and total production of 78,96,260 tons with 6.90 t/ha productivity. Thus, India contributes 73.25% of total world production of okra.

Okra, a highly adaptable crop, is grown throughout the country for its tender green fruits which are cooked and consumed in various forms and also used for canning. Besides being rich in protein, vitamins, minerals (especially iron) and dietary fibre, the high iodine content makes it unique among vegetables and helps it to play a vital role in controlling goitre disease especially for vegetarians. Seeds form a nutritious ingredient of cattle feed whereas mucilage finds its use in the manufacture of gums. The juice of over-ripe fruits is an ideal substitute for shampoo. Also, the plant as a whole serves as a source of fibre. Owing to these myriad uses, okra remains

in high demand in inland market along with great export potential. While formulating suitable breeding methodology for the improvement in this crop, attention must be paid for the improvement of visual appearance as well as the biochemical qualitative aspects too, besides the productivity. Hence, development of high yielding varieties with improved fruit parameters is an important need in the field of improvement of okra. Focusing on this objective, an attempt has been made to evaluate the fruit parameters in the available germplasm of okra.

Materials and Methods

The 101 okra genotypes, collected from various parts of India (Table 1) were laid out in randomised block design with two replications at a spacing of 60 x 45 cm and 10 plants/treatment/replication during summer 2001 to evaluate for yield and its attributes. Cultural and manurial practices were followed as per package of practices [Recommendations of KAU 1996]. Observations on fruit yield, yield attributes and fruit quality parameters viz., fruit number, average fruit weight (g), fruit yield [fruit weight/plant (g)], fruit length (cm), fruit girth (cm), fruit colour, fruit pubescence, ridges/fruit, seeds/fruit including biochemical traits viz., crude fibre content (%), protein content (g) and mucilage content (%) were recorded. Fruit colour and fruit pubescence were scored as per the NBPGR descriptors as detailed below:

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a) Fruit colour	Score
Green	1
Dark green	2
Yellowish green	3
Red	4
Dark red	5
Light green	6
Straited (green with purple)	7
Beige pink	8
Green with purple blend	9
Red purple	10
Watery green	11
b) Fruit pubescence	Score
Downy	1
Slightly rough	2
Prickly	3

Regarding the biochemical traits, crude fibre content was assessed from three fruits from each observational plant at the marketable stage by the method proposed by Chopra and Kanwar (1976) and expressed as percentage

Table 1. Germplasm of okra collected from various parts of India

S. No.	Variety/Genotype	National ID	Source
1.	NBPGR/TCR-128-A	IC45792 A	NBPGR Regional Station, Vellanikkara, Thrissur, Kerala
2.	NBPGR/TCR-760	IC85595	-do-
3.	NBPGR/TCR-776	IC113904	-do-
4.	NBPGR/TCR-808	IC218879	-do-
5.	NBPGR/TCR-874	IC282257	-do-
6.	NBPGR/TCR-893	IC282259	-do-
7.	NBPGR/TCR-985	IC282293	-do-
8.	NBPGR/TCR-1185	IC128072	-do-
9.	NBPGR/TCR-1471	EC169329A	-do-
10.	NBPGR/TCR-1479	EC169340	-do-
11.	NBPGR/TCR-1498	EC169363	-do-
12.	NBPGR/TCR-1507	EC169375	-do-
13.	NBPGR/TCR-1508	EC169378	-do-
14.	NBPGR/TCR-1524	EC169400	-do-
15.	NBPGR/TCR-1533	EC169414	-do-
16.	NBPGR/TCR-1552	EC169447	-do-
17.	NBPGR/TCR-1569	EC169485	-do-
18.	NBPGR/TCR-1581	EC169522	-do-
19.	NBPGR/TCR-1674	IC15435	-do-
20.	NBPGR/TCR-1676	IC15537	-do-
21.	NBPGR/TCR-1722	IC27898	-do-
22.	NBPGR/TCR-1728	IC29119A	-do-
23.	NBPGR/TCR-1753	IC31398A	-do-
24.	NBPGR/TCR-1777	IC34190	-do-
25.	NBPGR/TCR-1783	IC39132A	-do-
26.	NBPGR/TCR-1828	IC45728	-do-
27.	NBPGR/TCR-1871	IC52322	-do-
28.	NBPGR/TCR-1883	IC89712	-do-
29.	NBPGR/TCR-1899	IC90073	-do-
30.	NBPGR/TCR-1904	IC90082	-do-
31.	NBPGR/TCR-1929	IC90187	-do-
32.	NBPGR/TCR-1934	IC90200	-do-
33.	NBPGR/TCR-1943	IC90212	-do-
34.	NBPGR/TCR-1948	IC90222	-do-

S. No.	Variety/Genotype	National ID	Source
35.	NBPGR/TCR-1955	IC90230	-do-
36.	NBPGR/TCR-1956	IC90231	-do-
37.	NBPGR/TCR-1957	IC90233	-do-
38.	NBPGR/TCR-1963	IC90246	-do-
39.	NBPGR/TCR-1966	IC90251	-do-
40.	NBPGR/TCR-1968	IC90253	-do-
41.	NBPGR/TCR-1975	IC90269	-do-
42.	NBPGR/TCR-1981	IC90289	-do-
43.	NBPGR/TCR-1982	IC90291	-do-
44.	NBPGR/TCR-1988	IC93777	-do-
45.	NBPGR/TCR-1998	IC93777	-do-
46.	NBPGR/TCR-1999	IC99724	-do-
47.	NBPGR/TCR-2001	IC99726	-do-
48.	NBPGR/TCR-2019	IC108235	-do-
49.	NBPGR/TCR-2020	IC111014	-do-
50.	NBPGR/TCR-2040	IC111478	-do-
51.	NBPGR/TCR-2042	IC111480	-do-
52.	NBPGR/TCR-2048	IC111488	-do-
53.	NBPGR/TCR-2050	IC111490	-do-
54.	NBPGR/TCR-2055	IC111500	-do-
55.	NBPGR/TCR-2060	IC111507	-do-
56.	NBPGR/TCR-2061	IC111508	-do-
57.	NBPGR/TCR-2137	IC111734	-do-
58.	NBPGR/TCR-2145	IC117202	-do-
59.	NBPGR/TCR-2146	IC117202	-do-
60.	NBPGR/TCR-2168	IC117226	-do-
61.	NBPGR/TCR-2173	IC117229	-do-
62.	NBPGR/TCR-2177	IC117234	-do-
63.	NBPGR/TCR-2187	IC117244	-do-
64.	NBPGR/TCR-2192	IC117251	-do-
65.	NBPGR/TCR-2228	IC117300	-do-
66.	NBPGR/TCR-2235	IC117308	-do-
67.	NBPGR/TCR-2237	IC117310	-do-
68.	Anakkomban-I	.....	Palappoor, Thiruvananthapuram, Kerala
69.	Anakkomban-II	.....	Kalliyoor, Thiruvananthapuram, Kerala
70.	Arka Abhay	.....	IIHR, Bangalore, Karnataka
71.	Arka Anamika	.....	-do-
72.	Aruna	.....	College of Horticulture, Vellanikkara, Thrissur, Kerala
73.	Balusseri Local	.....	Balusseri, Kozhikode, Kerala
74.	Chittarikkal Local	.....	Chittarikkal, Kasaragod, Kerala
75.	Eranakulam Local	.....	Eranakulam, Kerala
76.	Goureesapattom Local	.....	Goureesapattom, Thiruvananthapuram, Kerala
77.	Kakkamoola Local	.....	Kakkamoola, Thiruvananthapuram, Kerala
78.	Kalavoor Local	.....	Kalavoor, Alappuzha, Kerala

S. No.	Variety/Genotype	National ID	Source
79.	Kanhangad Local	.....	Kanhangad, Kasaragod, Kerala
80.	Kannur Local Red	.....	Kannur, Kerala
81.	Kattayikkonam Local	.....	Kattayikkonam, Thiruvananthapuram, Kerala
82.	Kazhakkootam Local	.....	Kazhakkootam, Thiruvananthapuram, Kerala
83.	Kilikolloor Local	.....	Kilikolloor, Kollam, Kerala
84.	Kiran	.....	Department of Plant Breeding and Genetics, College of Agriculture, Vellayani, Kerala
85.	Kollam Local-1	.....	Kollam, Kerala
86.	Kollam Local-2	.....	-do-
87.	Koyilandy Local	.....	Koyilandy, Kozhikode, Kerala
88.	Mananthavady Local	.....	Mananthavady, Wayanad, Kerala
89.	Mavungal Local	.....	Mavungal, Kasaragod, Kerala
90.	MDU-1	.....	TNAU, Coimbatore, Tamil Nadu
91.	Nedumangad Local	.....	Nedumangad, Thiruvananthapuram, Kerala
92.	Nileshwaram Local	.....	Nileshwaram, Kasaragod, Kerala
93.	Pananchery Local	.....	Pananchery, Thrissur, Kerala
94.	Parbhani Kranti	.....	Marathwada Agricultural University, Parbhani
95.	Payyannur Local	.....	Payyannur, Kannur, Kerala
96.	Peechi Local	.....	Peechi, Thrissur, Kerala
97.	Pudukad Local	.....	Pudukad, Thrissur, Kerala
98.	Salkeerthi	.....	College of Horticulture, Vellanikkara, Thrissur, Kerala
99.	Selection-13	.....	Department of Plant Breeding and Genetics, College of Agriculture, Vellayani, Kerala
100.	Selection-46	.....	-do-
101.	Varsha Uphar	.....	Haryana Agricultural University, Hisar, Haryana

of fresh weight. Protein content of the fruits harvested at marketable stage was estimated as per the method adopted by Bradford (1976). The fruits harvested at the marketable stage formed the sample fruits for estimation of mucilage content. The mucilage content was estimated by following the method suggested by Hirst and Jones (1955). All other traits were recorded as per standard procedure routinely followed. The biometric observations recorded were subjected to ANOVA (Panse and Sukhatme, 1985) for comparison for yield and yield parameters among various treatments and to estimate variance components.

Results and Discussion

An insight into the extent of variability available in the genetic stock is of prime importance which provides the best picture of genetic gain achievable through selection. Critical assessment of nature and magnitude of variation is the first and the foremost step in formulating an effective breeding programme. In quantitative characters, phenotype is an unreliable indicator of genotype and hence it is desirable to test the genotypic value of individuals prior to selection. Since the observed variability in a population is the sum total of variation arising due to genotypic and environmental effects, knowledge on the nature and magnitude of genetic variation contributing to gain under selection is essential (Allard, 1960). Analysis of variance helps in partitioning the total phenotypic variation into components such as genotypic and environmental (error) variances, thereby providing information regarding the breeding value of genotypes involved and also the nature and magnitude of variability in the expression of a particular trait.

ANOVA revealed remarkable variation in all the traits under investigation (Table 2). Several research findings are available dealing with the varietal variation in okra with respect to many characters (Ariyo, 1990; Kumbhani *et al.*, 1993; Gondane and Lal, 1994; Bindu *et al.*, 1997). Significant works among them include those of Murthy and Bavaji (1980) for number, length and yield of fruits, Vashistha *et al.* (1982) for yield, Jeyapandi and Balakrishnan (1992) for seeds/fruit, Rajani and Manju (1997) for number, length, girth, weight and yield of fruits, Hazra and Basu (2000) for seeds/fruit and number, weight and yield of fruits, Philip *et al.* (2000) for number, weight, yield and crude fibre content of fruits, and Gandhi *et al.* (2001) for number, length, girth and seeds of fruits.

Table 2. ANOVA for fruit parameters in okra germplasm

S. No.	Character	Genotypic mean square (df = 100)
1.	Fruits/plant	9.82**
2.	Average fruit weight (g)	48.88**
3.	Fruit weight/plant (g)	9374.69**
4.	Fruit length (cm)	23.41**
5.	Fruit girth (cm)	1.55**
6.	Ridges/fruit	1.15**
7.	Seeds/fruit	195.72**
8.	Crude fibre content (%)	0.56**
9.	Protein content (g)	0.50**
10.	Mucilage content (%)	0.48**

The mean performance of the accessions for various fruit parameters are shown in Table 3. Fruit number varied significantly among the genotypes and it ranged from 2.50 (NBPGR/TCR-1981) to 13.67 (NBPGR/TCR-2020). NBPGR/TCR-1981 was at par with other four genotypes *viz.*, NBPGR/TCR-1676, NBPGR/TCR-1674, NBPGR/TCR-1581 and NBPGR/TCR-2235 whereas NBPGR/TCR-2020 was at par with Parbhani Kranti, Varsha Uphar, and MDU-1.

Average fruit weight showed wide range of variation among the genotypes from 12.18 (NBPGR/TCR-1533) to 34.47 (Kollam Local-1). Forty six genotypes were homogeneous with NBPGR/TCR-1533 while Kollam Local-1 was on par with NBPGR/TCR-1999, Goureesapattom Local, NBPGR/TCR-985, Parbhani Kranti, Varsha Uphar, Selection-13, Selection-46, Anakkomban-I, Anakkomban-II, Kannur Local Red and Payyannur Local.

Parbhani Kranti was the best yielder, with a fruit yield of 373.25 g/plant whereas the lowest fruit yielder was NBPGR/TCR-1981 with 34.52 g/plant. However, only two genotypes *viz.*, Varsha Uphar and NBPGR/TCR-985 were on par with Parbhani Kranti whereas several genotypes were low yielders similar to NBPGR/TCR-1981.

The length of fruit exhibited wide range of variation among the various genotypes (Fig. 1). The longest (27.18 cm) and the shortest (8.99 cm) fruits were produced by Anakkomban-II and NBPGR/TCR-1507 respectively. The length of fruits of Anakkomban-I and Payyannur Local was on par with that of Anakkomban-II.

The fruits with maximum girth (10.08 cm) were produced by Kilikolloor Local and Kollam Local-1. Fruit girth was minimum (4.20 cm) in NBPGR/TCR-1999, which exhibited similarity with thirty other genotypes.

The maximum score of 9 (green with purple blend) for fruit colour was observed for NBPGR/TCR-2020 and Kollam Local-1 whereas Peechi Local, Kattayikkonam Local, Nedumangad Local, Pananchery Local and Balussery Local secured the minimum score 1 (green).

The highest value of fruit pubescence was observed for NBPGR/TCR-1533 (3-prickly) and two accessions (NBPGR/TCR-1508 and NBPGR/TCR-1957) possessed medium value (2-slightly rough) while all the others exhibited minimum value (1-downy) for this trait.

Ridges/fruit among the various genotypes ranged from 5.00 to 8.17 (Fig. 2). Highest number of ridges per fruit was observed in Kazhakkootam Local (8.17). As pointed out by Hazra and Basu (2000), variation was low for ridges on fruits and moderate for fruit length.

Seventy genotypes had fruits with five ridges whereas other accessions including Kollam Local-1, Anakkomban-II, NBPGR/TCR-2020, Kilikolloor Local, Payyannur Local, Anakkomban-I, NBPGR/TCR-776, NBPGR/TCR-1728, NBPGR/TCR-893 and NBPGR /TCR-808 etc. possessed fruits with more than five ridges.

Seeds/fruit varied from 26.50 in NBPGR/TCR-2168 to 85.17 in Kazhakkootam Local (Fig. 3). NBPGR/TCR-2020 and Anakkomban-II were found to be at par with Kazhakkootam Local with respect to this character.

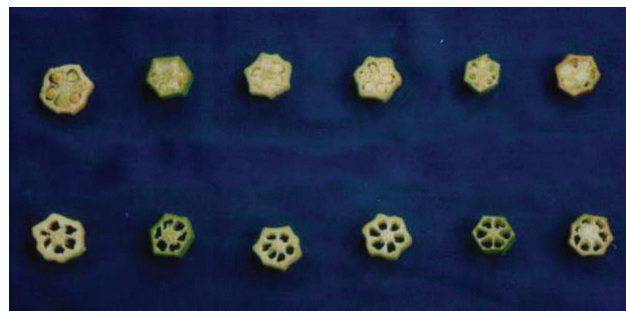
**Fig. 1. Variability in length and colour of okra fruits****Fig. 2. Variability in ridges and locules of okra fruits**

Table 3. Mean performance of 101 okra genotypes for fruit characters

S. No.	Genotype	Fruit number	Average weight (g)	Fruit yield/plant (g)	Fruit length (cm)	Fruit girth (cm)	Fruit colour	Fruit pubescence	No. of fruit ridges	No. of seeds/fruit	Crude fibre content (%)	Protein content (g)	Mucilage content (%)
		1	2	3	4	5	6	7	8	9	10	11	12
1.	NBPGR/TCR-128-A	5.75	24.29	140.36	20.12	5.95	2	1	5.00	56.84	2.20	0.74	1.40
2.	NBPGR/TCR-760	5.25	22.43	117.73	17.99	5.85	2	1	5.00	48.17	2.55	1.09	1.10
3.	NBPGR/TCR-776	5.80	18.40	123.90	15.53	4.85	6	1	6.90	53.50	2.55	1.03	1.40
4.	NBPGR/TCR-808	5.75	19.26	110.32	12.99	7.69	2	1	6.92	47.17	2.35	0.66	1.30
5.	NBPGR/TCR-874	6.98	26.51	184.69	16.09	5.70	3	1	6.00	59.34	1.10	0.40	2.00
6.	NBPGR/TCR-893	7.75	20.71	160.72	14.96	6.65	2	1	6.25	42.84	2.15	0.40	1.10
7.	NBPGR/TCR-985	11.90	27.62	327.46	21.26	5.73	7	1	5.17	55.84	1.40	2.50	1.30
8.	NBPGR/TCR-1185	5.38	19.69	105.94	13.95	5.40	3	1	5.00	44.75	1.55	0.19	1.80
9.	NBPGR/TCR-1471	5.09	20.45	103.22	17.00	5.83	6	1	5.00	32.75	2.55	0.24	1.10
10.	NBPGR/TCR-1479	6.09	16.10	100.48	10.70	4.73	2	1	5.00	39.25	2.00	0.77	1.50
11.	NBPGR/TCR-1498	10.97	24.85	272.26	17.65	5.80	2	1	5.13	58.05	1.45	0.92	1.49
12.	NBPGR/TCR-1507	5.00	20.75	103.75	8.99	5.94	2	1	5.00	58.67	2.90	0.07	1.50
13.	NBPGR/TCR-1508	6.15	20.80	129.71	13.60	4.95	2	2	5.00	48.25	2.45	0.44	1.44
14.	NBPGR/TCR-1524	7.40	18.71	137.70	14.12	5.69	2	1	5.53	63.92	1.05	0.34	2.04
15.	NBPGR/TCR-1533	4.47	12.18	54.30	11.24	5.47	2	3	5.00	34.04	3.65	1.49	1.00
16.	NBPGR/TCR-1552	5.50	15.55	86.14	12.60	5.00	3	1	5.00	55.00	0.75	0.20	3.07
17.	NBPGR/TCR-1569	6.25	21.69	135.38	15.55	5.40	2	1	5.00	46.59	0.70	0.30	3.07
18.	NBPGR/TCR-1581	4.10	14.25	58.32	12.38	5.13	2	1	5.00	44.00	1.55	0.30	1.80
19.	NBPGR/TCR-1674	4.00	16.46	64.85	12.04	4.57	2	1	5.00	41.34	1.85	0.46	1.30
20.	NBPGR/TCR-1676	3.90	14.75	57.61	11.29	4.84	6	1	5.00	45.75	1.05	0.11	2.00
21.	NBPGR/TCR-1722	5.09	16.46	83.51	15.05	5.14	6	1	5.00	48.25	1.40	0.31	2.06
22.	NBPGR/TCR-1728	4.30	16.41	70.60	12.91	5.54	2	1	6.25	38.17	2.15	0.29	1.50
23.	NBPGR/TCR-1753	6.00	15.39	91.47	10.93	5.40	3	1	5.00	39.75	2.15	0.76	1.40
24.	NBPGR/TCR-1777	7.13	22.15	157.85	19.65	4.93	3	1	5.00	44.17	1.80	0.33	1.40
25.	NBPGR/TCR-1783	6.50	20.40	132.57	14.63	4.95	3	1	5.00	40.50	2.15	0.62	1.10
26.	NBPGR/TCR-1828	5.50	25.91	144.96	16.78	5.56	6	1	5.00	45.38	2.20	1.50	1.30
27.	NBPGR/TCR-1871	7.70	20.71	160.31	16.52	5.02	6	1	5.00	40.50	2.30	0.10	1.30
28.	NBPGR/TCR-1883	5.00	14.84	74.18	10.82	4.44	3	1	5.00	38.17	1.65	0.20	1.55
29.	NBPGR/TCR-1899	8.75	20.73	182.29	15.19	5.70	6	1	5.00	55.34	1.90	0.59	1.45
30.	NBPGR/TCR-1904	5.70	25.22	144.03	11.35	6.45	6	1	5.00	42.67	2.50	0.49	1.30
31.	NBPGR/TCR-1929	6.67	17.72	118.59	13.45	5.48	6	1	5.00	41.00	1.70	0.56	1.20
32.	NBPGR/TCR-1934	9.43	20.18	190.87	14.92	5.29	3	1	5.00	41.17	1.50	0.57	1.10
33.	NBPGR/TCR-1943	4.75	19.93	93.43	14.88	5.46	3	1	5.33	40.25	1.95	0.20	1.50
34.	NBPGR/TCR-1948	5.50	14.35	78.48	11.73	5.17	6	1	5.00	48.17	1.75	1.77	1.50
35.	NBPGR/TCR-1955	5.30	18.88	99.45	15.34	5.54	7	1	5.00	37.50	2.30	0.17	1.50
36.	NBPGR/TCR-1956	11.50	23.50	269.91	15.37	5.92	2	1	5.63	44.84	1.60	0.84	1.00
37.	NBPGR/TCR-1957	6.00	20.04	120.24	12.93	5.80	6	2	5.00	42.25	2.30	0.24	1.10
38.	NBPGR/TCR-1963	5.54	17.66	97.99	15.05	5.06	2	1	5.00	30.92	1.85	0.51	1.40
39.	NBPGR/TCR-1966	5.92	17.82	103.96	15.65	4.92	6	1	5.00	47.67	1.20	0.60	1.80
40.	NBPGR/TCR-1968	5.35	13.40	71.58	11.83	4.30	3	1	5.00	45.50	2.30	0.54	1.20
41.	NBPGR/TCR-1975	6.00	15.12	92.28	11.65	4.68	3	1	5.00	37.25	1.80	0.55	1.40
42.	NBPGR/TCR-1981	2.50	13.89	34.52	11.65	4.45	3	1	5.67	46.00	1.90	0.20	1.90
43.	NBPGR/TCR-1982	5.50	17.04	93.27	11.93	4.25	6	1	5.75	52.50	1.55	0.37	1.30
44.	NBPGR/TCR-1988	5.85	15.78	92.21	14.17	5.70	6	1	5.00	45.75	1.90	0.49	1.18
45.	NBPGR/TCR-1998	5.45	17.02	92.78	14.23	5.04	6	1	5.00	32.17	2.00	0.72	1.35
46.	NBPGR/TCR-1999	5.34	17.10	90.44	13.78	4.20	3	1	5.00	38.00	2.15	0.09	0.90
47.	NBPGR/TCR-2001	8.00	27.77	222.97	16.95	6.02	2	1	5.50	51.00	2.10	0.21	1.30
48.	NBPGR/TCR-2019	10.53	24.79	258.36	16.58	5.87	2	1	5.00	50.73	2.30	0.89	1.05

S. No.	Genotype	Fruit number	Average weight (g)	Fruit yield/plant (g)	Fruit Length (cm)	Fruit girth (cm)	Fruit colour	Fruit pubescence	No. of fruit ridges	No. of seeds/fruit	Crude fibre content (%)	Protein content (g)	Mucilage content (%)
		1	2	3	4	5	6	7	8	9	10	11	12
49.	NBPGR/TCR-2020	13.67	16.52	225.79	11.62	6.05	9	1	7.80	80.50	2.90	0.83	1.2
50.	NBPGR/TCR-2040	5.00	14.38	71.90	12.24	5.32	3	1	5.00	34.92	1.30	0.03	2.0
51.	NBPGR/TCR-2042	5.95	14.90	89.32	11.82	4.92	3	1	5.00	34.34	2.40	0.29	1.4
52.	NBPGR/TCR-2048	8.20	22.44	182.28	15.35	5.89	2	1	5.00	49.09	2.40	2.20	1.3
53.	NBPGR/TCR-2050	5.84	22.80	133.41	15.15	5.81	6	1	5.00	49.63	1.65	1.39	1.4
54.	NBPGR/TCR-2055	8.50	20.40	172.89	15.38	4.65	3	1	5.00	41.00	2.60	1.54	1.3
55.	NBPGR/TCR-2060	12.10	23.86	288.89	17.80	5.63	2	1	5.25	48.00	3.10	0.53	1.4
56.	NBPGR/TCR-2061	8.20	17.79	142.78	14.29	5.02	3	1	5.00	43.59	1.60	0.61	1.3
57.	NBPGR/TCR-2137	9.15	23.66	215.81	14.81	6.03	2	1	5.00	48.17	0.85	0.37	3.6
58.	NBPGR/TCR-2145	4.50	13.78	61.82	11.89	4.74	6	1	5.00	41.92	1.70	0.71	1.5
59.	NBPGR/TCR-2146	7.15	16.17	115.31	13.55	4.45	3	1	5.50	41.00	1.70	0.34	1.2
60.	NBPGR/TCR-2168	5.67	18.37	103.89	15.30	4.85	3	1	5.00	26.50	1.15	0.38	2.3
61.	NBPGR/TCR-2173	4.94	12.88	62.73	12.64	5.47	3	1	5.00	31.42	2.40	0.40	1.2
62.	NBPGR/TCR-2177	4.50	15.19	68.36	10.48	4.78	3	1	5.00	32.25	2.60	0.13	1.5
63.	NBPGR/TCR-2187	6.75	20.43	137.94	14.47	5.68	2	1	6.00	62.17	2.00	1.41	1.3
64.	NBPGR/TCR-2192	6.50	19.04	123.11	14.38	5.78	6	1	5.00	51.00	2.20	1.06	1.3
65.	NBPGR/TCR-2228	8.85	15.06	133.19	11.65	5.15	3	1	5.00	40.34	1.10	0.89	1.8
66.	NBPGR/TCR-2235	4.80	12.70	60.05	11.52	5.11	6	1	5.00	44.50	2.30	0.33	1.3
67.	NBPGR/TCR-2237	4.13	15.91	65.60	11.33	4.73	7	1	5.00	32.50	1.40	0.20	1.7
68.	Anakkomban-I	4.50	30.78	136.85	23.87	6.14	2	1	7.34	52.50	2.25	0.26	1.5
69.	Anakkomban-II	4.75	29.78	140.43	27.18	6.35	6	1	8.00	70.09	2.10	0.99	1.4
70.	Arka Abhay	5.50	23.80	130.88	17.05	5.84	2	1	5.00	50.17	2.20	1.00	1.5
71.	Arka Anamika	7.80	24.84	193.80	18.97	5.69	2	1	5.00	45.59	1.95	0.33	1.3
72.	Aruna	5.90	25.60	150.73	19.66	4.95	4	1	5.00	50.17	2.10	0.46	1.5
73.	Balusseri Local	5.00	14.08	35.44	11.05	4.48	1	1	5.00	40.25	2.35	0.67	1.5
74.	Chittarikkal Local	5.75	25.85	156.10	11.46	4.84	2	1	5.00	41.34	2.10	0.94	1.2
75.	Eranakulam Local	4.67	20.71	97.00	16.53	5.50	6	1	5.00	54.50	1.65	0.40	1.8
76.	Goureesapattom Local	10.70	28.34	303.17	18.49	6.63	7	1	5.17	56.83	2.40	0.51	1.3
77.	Kakkamoola Local	7.80	22.97	179.87	16.65	5.82	6	1	5.00	34.84	2.10	1.66	1.2
78.	Kalavoor Local	6.00	15.43	94.74	12.63	5.38	6	1	5.00	47.25	0.75	1.21	4.0
79.	Kanhangad Local	5.67	22.19	125.73	16.14	4.94	6	1	5.25	43.25	2.65	0.65	1.1
80.	Kannur Local Red	5.80	29.92	172.38	22.25	5.57	4	1	6.00	56.25	1.80	0.25	2.0
81.	Kattayikkonam Local	4.65	18.56	86.19	15.38	5.13	1	1	5.25	38.67	1.05	0.81	2.2
82.	Kazhakkootam Local	5.50	22.22	121.94	16.59	6.89	6	1	8.17	85.17	2.65	0.94	1.1
83.	Kilikolloor Local	5.25	19.67	103.38	13.53	10.08	7	1	7.75	62.00	2.35	0.88	1.4
84.	Kiran	5.80	24.94	144.65	17.57	5.13	6	1	5.00	52.00	1.70	0.62	1.4
85.	Kollam Local-1	6.10	34.47	210.23	15.49	9.91	9	1	8.00	68.09	2.25	1.33	1.5
86.	Kollam Local-2	5.25	18.44	97.08	12.59	5.14	7	1	5.00	33.00	2.45	1.11	1.1
87.	Koyilandy Local	4.60	15.63	71.59	12.18	4.63	6	1	5.00	49.75	2.25	0.92	1.4
88.	Mananthavady Local	5.38	27.26	146.83	20.62	6.09	2	1	5.00	46.42	2.10	0.35	1.6
89.	Mavungal Local	6.50	19.40	125.29	22.17	5.58	2	1	5.00	40.25	1.50	1.80	1.7
90.	MDU-1	12.40	23.70	293.28	19.14	5.96	2	1	5.00	58.50	1.55	1.20	1.0
91.	Nedumangad Local	6.75	15.71	106.26	12.55	6.30	1	1	5.00	52.17	2.05	1.14	1.5
92.	Nileshwaram Local	5.35	15.59	99.19	12.50	5.23	2	1	5.00	43.00	1.85	1.16	1.4
93.	Pananchery Local	5.09	18.78	94.53	13.25	5.38	1	1	5.00	50.00	1.85	0.46	1.4
94.	Parbhani Kranti	12.70	29.41	373.25	18.80	5.72	7	1	5.25	47.89	2.10	2.02	1.1
95.	Payyannur Local	4.44	28.37	125.41	22.75	6.03	2	1	7.50	50.50	2.15	0.26	1.5
96.	Peechi Local	9.40	24.65	231.99	16.67	6.08	1	1	5.00	44.50	1.35	0.20	1.8
97.	Pudukad Local	5.80	16.44	95.35	17.07	5.49	6	1	5.25	58.63	2.25	0.99	1.4

S. No.	Genotype	Fruit number	Average weight (g)	Fruit yield/plant (g)	Fruit length (cm)	Fruit girth (cm)	Fruit colour	Fruit pubescence	No. of fruit ridges	No. of seeds/fruit	Crude fibre content (%)	Protein content (g)	Mucilage content (%)
		1	2	3	4	5	6	7	8	9	10	11	12
98.	Salkeerthi	5.17	24.56	125.97	21.16	5.62	6	1	5.00	38.13	1.90	0.58	1.80
99.	Selection-13	6.70	28.85	192.17	21.63	6.25	2	1	5.00	42.00	2.20	0.39	1.70
100.	Selection-46	5.90	30.28	178.53	19.10	5.62	2	1	5.50	42.25	1.30	0.38	2.20
101.	Varsha Uphar	12.65	27.58	348.44	19.31	5.54	2	1	5.34	52.90	2.00	0.48	1.30
	Mean	6.49	20.43	136.45	15.18	5.52	—	—	5.31	46.44	1.95	0.69	1.52
	SE	0.64	2.71	21.11	1.74	0.51	—	—	0.31	5.93	0.26	0.28	0.27
	CD	1.68	7.10	55.31	4.56	1.34	—	—	0.81	15.54	0.68	0.73	0.71



Fig. 3. Variability in seeds of okra fruits

Among the significantly varying genotypes, NBPGR/TCR-1533 had the highest fibre content (3.65 %) and NBPGR/TCR-2060 was at par with NBPGR/TCR-1533. Fibre content was the lowest in NBPGR/TCR-1569 (0.70 %). Crude fibre content (13.1 to 14.3 %) in okra fruits was earlier reported by Elangovan *et al.* (1983).

Protein content was the highest (2.50 g) in the fruits of NBPGR/TCR-985 and NBPGR/TCR-1948, NBPGR/TCR-2048, Mavungal Local and Parbhani Kranti was at par with NBPGR/TCR-985. NBPGR/TCR-2040 had the lowest protein content (0.03 g).

The highest mucilaginous type Kalavoor Local (4.0 %) was at par with NBPGR/TCR-2137. NBPGR/TCR-1999 (0.9 %) had the lowest mucilage content which was at par with 77 genotypes.

High yield was observed for Parbhani Kranti in this study is in accordance those of Singh *et al.* (1993) and Lal *et al.* (2001). Singh (2000) reported that Parbhani Kranti displayed high yield and fruit weight along with high resistance to YVM consistently for three years which corroborates with the present findings.

Screening of germplasm comprising 101 okra genotypes for yield and component traits revealed significant variation among the genotypes. Based on overall performance, eight superior genotypes *viz.*, NBPGR/TCR-985, NBPGR/TCR-1498, NBPGR/TCR-2019, NBPGR/TCR-2020, NBPGR/TCR-2060, MDU-1, Parbhani Kranti and Varsha Uphar were selected for hybridization programme to develop F₁ hybrids.

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