Classification of Rapeseed-mustard Varieties Based on Seed Quality to Select Parental Types for Breeding Programme

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Forty-four varieties of different *Brassica* group of crop among released and notified varieties having best quality traits were selected to classify into different clusters to select parental types for breeding programme. All the varieties were classified into six clusters considering 10 quality traits (Table 1) using SPAR-2 and INDOSTAT software programme. Though the varieties in 3 clusters (Cluster #1, #5 and #6) are having a mixture of different *Brassica* species, but having best quality traits which can be selected for breeding programme, available within the species in different clusters to enhance the quality of oil in different *Brassica* crops. It was also revealed from the study that statistically all the species of *Brassica* are same in quality as they fell in the same cluster.

Key Words: Breeding, Classification, Rapeseed-mustard

Introduction

Varieties are the key factors of modern technologies to enhance production and contribute 25 to 35 per cent in it. Viewing the present scenario of different oil quality in international market, it is urgently required to improve the quality of rapeseed-mustard oil to lower the cholesterol level in blood to sustain in the international market. Saturated fatty acids (SFA) in high percentage are undesirable as they are of hypercholesteremic nature. However, monounsaturated fatty acids (MUFA) and long chain polyunsaturated fatty acids (PUFA) are nutritionally desired quality of oil. These two unsaturated fatty acids are known to lower the cholesterol level in blood, as they are hypocholesteremic nature (Mathur and Sharma, 1991). Further, polyunsaturated fatty acids, namely, linoleic acid (w-6) and linolenic acid (w-3) are essential fatty acids as our body can not synthesize them and they are involved in many important metabolic functions. Rapeseed-mustard oil is the second most important source of vegetable oil in the world. The total consumption of the rapeseed-mustard oil in India is estimated about 1.91 million MT (Kochu Babu, 2007). Mustard oil has a high proportion of unsaturated fatty acids and mix of both monounsaturated and polyunsaturated fatty acids. It has also lower saturated fatty acid content than other edible oil. Mustard oil due to its odour and pungency is the preferred oil from many parts of India. Till date classification of rapeseed-mustard has been done based on the morphological characters of yield attributes (Mishra *et al*., 2007).

The present study was undertaken with an aim to classify rapeseed-mustard varieties into different groups/ clusters based on the quality aspects of released and notified rapeseed-mustard varieties with a view to improve the quality of *Brasicca* crops after hybridization.

Materials and Methods

Based on passport data available (Chauhan *et al.*, 2001; Chauhan and Singh, 2004) on maturity of rapeseed-mustard crop (early, medium and late), stratified random sampling procedure was adopted to select 44 released and notified most popular different *Brassica* species for this study. The varieties of different *Brassica* species were selected such as, 2 from brown sarson, 4 from gobhi sarson, 7 from toria, 2 from yellow sarson, 27 from Indian mustard and 2 from Karan rai for this study. NIR (Dickey-Johan, USA) based method from intact seed which is faster, cost effective, environmentally safe, cheaper and nondestructive is used to record 10 different quality characters, namely, oil content; protein; fibre; glucosinolate (GSN); saturated fatty acid (16:0 + 18:0); oleic acid (18:1); linoleic acid (18:2); linolenic acid (18:3); eicosanoic acid (20:1) and erucic acid (22:1) for classification of 44 notified varieties into different groups/ clusters to select parental types for further breeding programme to enhance the oil quality of *Brassica* seed (Carpenter *et al*., 1976).

Results and Discussion

The 10 quality characters along with mean and CV were considered to be the base for classification into different

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clusters. Viewing the CV of different quality characters it revealed that the most variable quality character is fibre (cv=36.01) followed by oleic acid (cv=31.59); ecosonoic acid (cv=24.19); linolenic acid (cv=20.31); glucosinolate (cv=19.81) and saturated fatty acid (cv=19.13) (Table 1). SPAR-2 software developed by IASRI, New Delhi, was used to analyze the data for group classification. All the 44 varieties were classified into six groups/ clusters as F-Statistics (Rao, 1952) in the process of statistical analysis, is found maximum in the case of cluster # 6. Viewing within mean sum of square calculated using INDOSTAT software, it revealed that most variable cluster was cluster # 5 (wmss=40.8), followed by cluster # 2 (wmss=32.3), cluster # 4 (wmss=26.1), cluster # 3 (wmss=21.3), cluster # 1 (wmss=17.9) and cluster 6 (wmss=17.4) (Table 2) (Mishra *et al*., 2007). Though the varieties in 3 clusters (cluster # 1, # 5 and # 6) are having a mixture of different *Brassica* species, but having best quality traits which can be selected for breeding programme, available within the species in different clusters to enhance the quality of oil in *Brassica* crops. It was also revealed from the study that quality wise and statistically all the species of *Brassica* were same as they fell in the same cluster. Viewing correlations of different characters it revealed that only saturated fatty acid (16:0 + 18:0) is having positive significant correlation at 1% level of significance with that of oleic acid (18:1) and ecosanoic acid (20:1), but having negative significance correlation at 1% level of significance that with erucic acid (22:1). Protein is also having negative significant correlation (at. 01 levels) with fibre. Oleic acid (18:1) is having negative significant correlation (at. 01 levels) that with linolenic acid (18:3) and erucic acid (22:1). Similarly, it revealed from the correlation table that linoleic acid (18:2) is having negative significant correlation with erucic acid (22:1). Ecosanoic acid (20:1) is also having negative significant correlation (at 0.01 levels) with erucic acid (22:1) (Table 3). Mean and coefficient of variance (CV) of all the characters of different clusters have been calculated (Table 4 and 5). As far as saturated fatty acid (16: 0 + 18:0) is concerned between clusters, it is in desirable level. The maximum fatty acid was observed in cluster # 2 (3.00), followed by cluster # 3 (2.95); cluster # 6 (2.35); cluster # 4 (2.32) and cluster # 1 (2.22) etc. Oleic acid (18:1), a constituent of MUFA, the most vital component of oil, good for health was observed maximum in cluster # 3 (16.17); followed by cluster # 1 (12.45); cluster # 4 (12.26); cluster # 2 (12.1) etc. So, the varieties in these clusters may be selected for breeding purposes to have good quality of oil (Table 4). A comparative study of variability in oleic acid (18:1) between the clusters have been observed and found maximum variability in cluster # 3 (CV=49.44) followed by cluster # 6 (CV=27.40); cluster # 4 (CV=25.78) and cluster # 1 (CV=15.95) etc. (Table 5). It was further observed that maximum variability as well as mean between the clusters for linoleic acid (18:2), a constituent of PUFA was found in cluster # 4 (CV=21.86; mean=17.23, respectively) (Table 4 and 5), so varieties from cluster # 4 may be selected for breeding purposes to take care of linoleic acid (18:2) in the oil. Erucic acid (22:1) between the clusters was observed maximum in cluster # 5 (53.48) (Table 4), but variability in the same cluster was observed 4.33 (Table 5), so the varieties of cluster # 5 may be selected for breeding programme within species to reduce erucic acid (22:1) in the oil.

Table 1. Characters, their mean and coefficient of variance (CV)

S.No.	Character Name	Mean	CV
1	Oil content	40.13	4.13
2	Protein	20.58	4.85
3	Fibre	10.68	36.01
4	Glucosinolate (GSN)	84.71	19.81
5	Saturated fatty acid 16:0+18:0	2.40	19.13
6	Oleic acid (18:1)	12.51	31.59
7	Linoleic acid (18:2)	16.13	12.74
8	Linolenic acid (18:3)	12.30	20.31
9	Eicosanoic acid (20:1)	8.41	24.19
10	Erucic acid (22:1)	48.16	10.78

Table 2. Classified # 6 clusters based on 10 qualities traits mentioned in Table 1

Cluster	No. of varieties	Mean	Within MSS	Name of the varieties
1	8	24.87	17.9	Kranti, Pusa Bold, RH-30, RH 781, RL-1359, Rohini, JT 1, PT 507
2	2	27.52	32.3	Kiran, PC-5
3	6	22.41	21.3	RCC 4, Sanjucta A, TH 68, KBS 3,Neelam, Sheetal
4	8	27.65	26.1	Basanti, Krishna, PBR-91, PCR-7, Pusa Bahar, Pusa Jag, Bhawani, PBT 37
5	7	25.99	40.8	CS-52, RH 8812, RH 8113, Varuna, PT 303, Jhumka, Pusa Gold
6	13	25.75	17.4	Bio-902, GM-1, GM-2, JM-1, PBR-97, RH 819, RN 393, Sej-2, Vardan, TL 15, KS 101, GSL 1, GSL 2

Table 3. Correlations of different characters

Characters	Oil	Protein	Fibre	GSN	16:0+18:0	18:1	18:2	18:3	20:1	22:1
Oil	–	–0.193	0.121	–0.114	–0.034	–0.032	–0.225	–0.287	0.194	0.217
Protein		–	–0.400**	–0.100	0.134	0.204	0.192	0.076	–0.041	–0.260
Fibre			–	–0.21	–0.155	–0.012	–0.148	–0.248	0.004	0.227
GSN				–	–0.255	–0.270	–0.033	0.138	–0.173	0.235
16:0+18:0					–	0.642**	0.154	–0.265	0.588**	–0.755**
18:1						–	0.088	–0.533**	0.289	–0.708**
18:2							–	–0.001	–0.054	–0.455**
18:3								–	–0.208	0.046
20:1									–	–0.529**
22:1										–

** Correlation is significant at the 0.01 level.

Table 4. Cluster wise mean of different characters along with over all mean of all the characters

Cluster	Oil	Protein	Fibre	GSN	16:0+18:0	18:1	18:2	18:3	20:1	22:1
1	39.63	20.73	10.94	77.45	2.22	12.45	16.11	13.21	8.50	47.49
2	38.44	20.55	10.67	105.59	3	12.1	16.55	12.45	10.8	45.1
3	40.15	20.93	9.14	53.89	2.95	16.17	16.88	11.30	9.49	43.23
4	40.10	20.68	8.73	106.99	2.32	12.26	17.23	12.5	7.98	47.66
5	40.99	20.02	16.21	82.32	2.13	11.14	15.23	10.71	7.67	53.48
6	40.23	20.58	9.46	87.77	2.35	11.80	15.53	12.91	8.13	48.77
Over all mean	40.13	20.58	10.68	84.71	2.40	12.51	16.13	12.30	8.41	48.16

Table 5. Cluster wise CV of different characters along with over all CV of all the characters

Cluster	Oil	Protein	Fibre	GSN	16:0+18:0	18:1	18:2	18:3	20:1	22:1
1	5.74	5.25	35.98	3.74	15.02	15.95	8.91	15.80	21.96	5.43
2	7.05	4.27	5.77	10.74	4.71	5.84	7.26	24.42	5.24	4.08
3	1.58	4.64	7.29	9.65	20.28	49.44	10.06	13.12	33.91	16.90
4	3.35	3.07	13.85	6.82	14.31	25.78	21.86	19.37	20.84	12.76
5	4.04	5.26	34.20	6.25	10.75	19.18	5.83	21.96	12.19	4.33
6	3.96	5.67	21.85	3.73	17.40	27.40	9.04	23.20	25.56	7.89
Over all CV	4.13	4.85	36.01	19.81	19.13	31.59	12.74	20.31	24.19	10.78

Conclusion

Considering inter and intra distance matrix of the different clusters (Table 6), breeding can be performed between the varieties of cluster # 5 and cluster # 1 (d=2.11) followed by cluster # 6 and cluster # 1 (d=2.11); cluster # 5 and cluster #6 (d=2.26) cluster # 6 and cluster # 4 (d=5.41) etc. to improve the quality of rapeseed-mustard oil for good health (Chauhan *et al.*, 2004).

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Table 6. Inter- and Intra-distance matrix of six clusters

Cluster	1	2	3	4	5	6
1	1.02	99.49	7.76	10.35	2.11	2.11
2		5.60	122.76	96.53	88.29	97.78
3			3.24	31.06	11.99	13.94
4				2.54	8.87	5.41
5					1.57	2.26
6						1.19

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