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Biochemical profiling of *Brassica juncea* Germplasm

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Abstract
Brassica juncea is an economically important oilseed crop, which is grown in almost all parts of India and used as edible oil, vegetables, condiments and fodder. In spite of its uses, oil is not valued much due to the presence of high amount of anti-nutritional compounds like glucosinolates and erucic acid. In the present study oil content, erucic acid and glucosinolates was estimated in ninety genotypes of East European and Indian gene pool of *Brassica juncea.* The oil content varied from 31.90 percent to 44.16 percent. Maximum oil content was yield by the genotype PGR 12573 and EC 287711 (44.16%) followed by Stoke (44.01%) and Jubilejnaja (43.54%). Minimum erucic acid content was found in genotype Donskaja IV (12.18%) followed by Volgogradskaja 1891 (12.69%) and PGR 12573 (14.29%) genotypes. The glucosinolate content varied from 28.92 µmole/gm to 120.41 µmole/gm. Minimum glucosinolate content was found in Heera (28.92 µmole/g). These genotypes can be used in future breeding programmes for the improvement of these traits in *Brassica* species.

Keywords: *Brassica juncea*, Germplasm, glucosinolates, erucic acid

Introduction
Brassica juncea is an important oilseed species in India, China and Pakistan (Adhikari *et al*., 2021) [1]. It is a major oilseed crop of Indian subcontinent and the second most important source of edible oil, contributing about 30 percent to the total edible oilseeds production in the country (Anupriya *et al*., 2020) [2]. It occupies major area in India and contributes more than 80 percent of the total rapeseed mustard production (Yadava *et al*., 2012) [10]. Mustard oil is used directly in cooking and it has a significant number of unsaturated fatty acids and only a little amount of saturated fatty acids. The relatively high level of oleic acid and optimal balance between linolenic and linoleic acids makes mustard oil very healthy edible oil. In spite of its uses, oil is not valued much due to the presence of high amount of anti-nutritional compounds like glucosinolates and erucic acid. Erucic acid (C22:1), a long-chain monounsaturated fatty acid is a major fraction (~50%) of the seed oil in Brassica species. Low erucic acid content is the desirable trait in Brassica species. Plants belonging to Brassicaceae family are rich in secondary metabolites called glucosinolates. In oilseed Brassica, the de-oiled cake is a rich source of glucosinolates. Upon disruption of tissue, the glucosinolates come in contact with the myrosinase enzyme to break down into isothiocyanates producing its characteristic pungency. In order to reduce the pungency, breeding programmes worldwide are aiming to eliminate glucosinolates in oilseed Brassica. Thus, a lot of efforts are being made for the improvement of existing cultivars and development of new varieties with high oil and low glucosinolates and erucic acid content. Hence, the present study was conducted to estimate the oil content, erucic acid and glucosinolates among the ninety diverse germplasm of Indian and European gene pool of mustard.

Materials and Methods
Oil content in percent was estimated by Infratech™ 1241 Whole Grain Analyzer (Foss Alle, Denmark) based on the principle of near-infrared transmittance technology. Transmittance mode measurements were made in a lower wavelength range, 570 - 1050 nm, whereas the primary information for reflectance measurements was obtained between 1100 - 2500 nm. Erucic acid content in samples was estimated by ^{13}CNMR using JEOL ECA-400 MHz NMR spectrometer at a frequency of 100.40 MHz fitted with a 5-mm-i.d. dual probe as per protocol adopted by Kok *et al.* (2018) [5]. The longest relaxation time was found to be 5.0 seconds. Experimental temperature was set at 25 °C with acquisition time of 0.37s. The signals were obtained based on chemical shift value generally expressed in ppm. Standard JEOL ALICE processing software was used.

Glucosinolate content (µmole/g) was estimated by spectrophotometric estimation using methanolic extract (Mawlong *et al*., 2017) [6].

Results and Discussion

The oil content varied from 31.90 percent to 44.16 percent (Table 1). Maximum oil content was yield by the genotype PGR 12573 and EC 287711 (44.16%) followed by Stoke (44.01%) and Jubilejnaja (43.54%). The erucic acid content varied from 12.18 percent to 45.61 percent. Minimum erucic acid content was found in genotype Donskaja IV (12.18%) followed by slightly high content in Volgogradskaja 1891 (12.69%) and PGR 12573 (14.29%) genotypes. The glucosinolate content varied from 28.92 µmole/gm to 120.41 µmole/gm. Minimum glucosinolate content was found in Heera (28.92 µmole/g). Other genotypes which had relatively lower glucosinolate contents included Zaria (47.75 µmole/g), Sendai Bashouna (47.75 µmole/g), Ooba Takana (48.75 µmole/g), Stoke (48.94 µmole/g), J/817/2 (42.64 µmole/g), J/824 (49.92 µmole/g), Cutlass (48.14 µmole/g), SRS 319 (49.24 µmole/g), M.Br.4 (49.24 µmole/g), German accession No. 114 (49.24 µmole/g), Zem 1 (45.64 µmole/g), Skorospieka II (49.24 µmole/g), EC 206712 (49.29 µmole/g). Verma *et al*. (2016) [8] reported oil content in *Brassica juncea* ranges from 30.3-42.0 percent. Fu *et al*. (2017) [3] studied association mapping using 142 rapeseed lines with diversity in oil content. Yadav *et al*. (2018) [9] and Rout *et al*. (2018) [7] reported variation in oil content and erucic acid in *Brassica juncea* varieties and identified Donskaja IV as high yielding genotype. Gupta *et al*. (2012) [4] studied glucosinolate content in *Brassica juncea* using NIRS (Near Infrared Reflectance Spectroscopy. Mawlong *et al*. (2017) [6] studied total glucosinolates in different genotypes of *Brassica juncea* using HPLC and spectrophotometric method.

Table 1: Biochemical profiling of *Brassica juncea* germplasm

S. No.	Genotypes	Oil Content (%)	Erucic Acid (%)	Glucosinolates (µ mole/g)
1	Neosypajuscajasia 2	38.86	18.82	51.32
2	Volgogradskaja1891	39.63	12.69	54.88
3	Skorospelka	41.81	16.73	48.94
4	VNIIMK 351	38.42	15.98	50.13
5	VNIIMK 405	41.67	15.64	54.88
6	Zeltosemiannaja 230	40.23	18.29	59.64
7	Zaria	41.24	29.84	47.75
8	Donskaja 4	40.33	12.18	52.83
9	PGR 3330	39.20	16.64	53.20
10	PGR 3383	40.09	16.29	58.45
11	Commercial Brown Mustard	38.59	19.16	59.01
12	Lethbridge 22A	41.29	18.29	54.39
13	Blaze	42.46	27.04	57.96
14	Domo	35.28	16.79	50.13
15	AC Vulcan	37.14	36.19	51.32
16	Yanagawa Shirokuki	42.29	42.01	52.50
17	Miike Akachirimen	41.42	20.29	56.06
18	Sendai Bashouna	40.16	20.96	47.75
19	Ooba Takana	41.29	14.64	48.94
20	Burgonde	40.64	22.29	53.69
21	Ekla	42.13	28.64	52.51
22	Primus	41.79	16.29	50.13
23	Stoke	44.01	22.42	48.94
24	Jubilejnaja	43.54	28.92	52.50
25	Skorospelka 2	43.29	18.64	51.32
26	PGR 12568	40.14	27.94	58.45
27	74/5	42.30	17.64	57.26
28	PGR 12573	44.16	14.29	58.64
29	PGR 12574	39.26	22.14	55.58
30	Stepniacka	38.16	15.69	54.88
31	J807/1/6	40.82	21.19	58.83
32	J/807/12/1	40.45	25.94	59.02
33	J/817/2	42.14	32.19	42.64
34	J/824	42.29	42.69	49.92
35	J/824/6	41.10	30.49	53.64
36	PGR 12586	39.45	19.52	59.64
37	Cutlass	39.52	25.10	48.14
38	Scimitar	41.08	27.92	55.64
39	SRS 319	37.54	17.46	49.24
40	I-49-24	39.89	19.33	56.69
41	M.Br.4	35.69	21.52	49.24
42	63-0134-68	40.19	22.12	53.09
43	64-1398-69	41.20	36.24	58.93
44	Bass	36.29	21.14	53.64
45	R 871	38.16	15.93	55.34

46	Kafiav N Zagora	37.29	16.14	59.61
47	German accession No. 114	38.54	23.69	49.24
48	Zem 1	42.14	27.24	45.64
49	Skorospieka II	39.24	35.14	49.24
50	EC 287711	44.16	34.36	50.09
51	EC 491584	38.56	39.59	52.16
52	EC 206712	39.29	37.61	48.29
53	EC 699059	38.19	34.66	55.69
54	EC 699038 –I	40.16	28.21	58.12
55	EC 699038-II	42.55	31.15	59.84
56	*B. juncea* from Turkey	39.71	27.64	55.29
57	PGR 12585	40.99	15.93	65.61
58	PAK 85387	40.11	36.64	64.12
59	PAK 85483	39.50	31.29	62.64
60	PAK 85506	40.35	38.45	68.24
61	PAK 85590	40.96	19.29	63.04
62	PAK 85667	35.29	26.24	65.29
63	Toria Mitha	34.15	35.14	60.06
64	Desi Saram	38.68	32.64	58.98
65	Sharsham	39.37	27.29	63.64
66	PAK 85393	35.29	45.16	61.94
67	Raya (L.23)	41.16	39.28	60.64
68	SB-12-P4	37.97	40.64	89.64
69	RLM-240	39.42	35.93	89.24
70	RLC 1021	36.29	38.49	95.64
71	Krishna	35.16	35.29	90.21
72	Rohini	37.29	34.18	92.14
73	Vardan	38.14	29.59	95.64
74	IB 1479	39.29	45.61	100.29
75	IB 1436	38.98	31.49	98.16
76	Pusa Tarak	40.23	39.26	99.24
77	RSPR-01	39.27	34.64	84.19
78	Urvashi	41.40	43.19	89.32
79	DRMR-2017	40.92	42.21	92.12
80	Pusa Mehak	39.28	44.64	102.14
81	Pusa Karishma	31.90	21.29	100.96
82	Varuna	34.23	33.24	118.29
83	Kranti	35.69	30.64	115.29
84	RSPR-69	38.03	40.29	104.24
85	Pusa Bold	39.57	34.64	108.64
86	Heera	38.29	16.64	28.92
87	DMR-J-31	42.62	26.94	89.29
88	RSPR-03	39.87	29.64	90.21
89	RH-749	37.54	24.22	120.41
90	RB-55	41.09	20.24	102.21

Conclusion

In the present study oil content, erucic acid and glucosinolates was estimated in ninety genotypes of East European and Indian gene pool of *Brassica juncea.* Maximum oil content was yield by the genotype PGR 12573 and EC 287711 (44.16%) followed by Stoke (44.01%) and Jubilejnaja (43.54%). Minimum erucic acid content was found in genotype Donskaja IV (12.18%) followed by Volgogradskaja 1891 (12.69%) and PGR 12573 (14.29%) genotypes. Minimum glucosinolate content was found in Heera (28.92 µmole/g). These genotypes can be used in future breeding programmes for the improvement of these traits in *Brassica* species.

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