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Supplementary files

Supplementary Table 1. List of crosses along with parents

Sl. No.	Parents
1	**EC 676653**
2	**EC 597328**
3	**IC 051151**
4	**RH1222-28**
5	**Varuna**
6	**RH749**
7	**Giriraj**

Sl. No.	Crosses / Hybrids			
1	H1	EC 676653	×	RH 1222-28
2	H2	EC 676653	×	Varuna
3	H3	EC 676653	×	RH 749
4	H4	EC 597328	×	RH 1222-28
5	H5	EC 597328	×	Varuna
6	H6	EC 597328	×	RH 749
7	H7	IC 051151	×	RH 1222-28
8	H8	IC 051151	×	Varuna
9	H9	IC 051151	×	RH 749
10	H10	IC 051151	×	Giriraj
11	H11	RH 1222-28	×	Varuna
12	H12	RH 1222-28	×	RH 749
13	H13	EC 597328	×	IC 051151
14	H14	RH 1222-28	×	Giriraj
15	H15	Varuna	×	RH 749
16	H16	Varuna	×	Giriraj
17	H17	RH 749	×	Giriraj
18	H18	EC 676653	×	Giriraj
19	H19	EC 597328	×	Giriraj
20	H20	EC 676653	×	EC 597328
21	H21	EC 676653	×	IC 051151

Supplementary Table 2. Analysis of variance (ANOVA) for all 12 agro-morphological traits

SoV	df	DFF	DM	MRL	NPB	NSB	NSMR	NSP	PH	SL	SS	TW	YPP
Replication	1	209.44**	661.72**	191.29*	0.13ns	1.06ns	67.32ns	1934.05ns	793.51**	0.19ns	2.28ns	4.98**	4.17*
Genotypes	27	29.03**	9.87*	58.35*	2.54**	11.31**	42.59**	4295.88**	208.64**	0.24*	3.59**	0.75**	9.74**
Error	27	0.87	4.98	30.08	0.55	2.28	16.02	659.22	68.36	0.1	1.03	0.03	0.75
***F* Value**		33.34	1.98	1.93	4.62	4.95	2.65	6.51	2.05	2.33	3.47	28.55	13.05
***p* Value**		<0.001	0.041	0.045	<0.001	<0.001	0.006	<0.001	0.002	0.01	<0.001	<0.001	<0.001
CV %		1.6	1.86	10.14	13.26	15.18	11.89	14.35	4.86	6.37	7.43	4.28	11.22

*Significant at 5 % level ($p < 0.05$); **Significant at 1 % level ($p < 0.01$); ns: non-significant.
SoV: Source of Variation; df: Degree of freedom; DFF: days to 50 % flowering; DM: days to maturity; MRL: main raceme length; NPB: number of primary branches; NSB: number of secondary branches; NSMR: number of siliquae on main raceme; NSP: number of siliquae per plant; PH: plant height; SL: siliquae length; SS: seeds per siliquae; TW: test weight; YPP: yield per plant.

Supplementary Table 3. Analysis of variance (ANOVA) for combining ability in Indian mustard

SoV	df	PH	NPB	NSB	SL	SS	MRL	NSMR	NSP	YPP	TW	DFF	DM
Replication	1	793.51**	0.13	1.06	0.19	2.28	191.29*	67.32	1934.05	4.17*	4.98**	209.44**	661.72**
Genotype	27	208.64**	2.54**	11.31**	0.24*	3.59**	58.35*	42.59**	4295.88**	9.74**	0.75**	29.03**	9.87*
Error	27	68.36	0.55	2.28	0.1	1.03	30.08	16.02	659.21	0.75	0.03	0.87	4.98

*Significant at $P < 0.05$; **Significant at $P < 0.01$. SoV: Source of Variation; df: Degree of freedom; DFF: days to 50 % flowering; DM: days to maturity; MRL: main raceme length; NPB: number of primary branches; NSB: number of secondary branches; NSMR: number of siliquae on main raceme; NSP: number of siliquae per plant; PH: plant height; SL: siliquae length; SS: seeds per siliquae; TW: test weight; YPP: yield per plant.

Supplementary Table 4: General combining ability effects of seven parents for 12 traits in Indian mustard

Parents	PH	NPB	NSB	SL	SS	MRL	NSMR	NSP	YPP	TW	DFF	DM
P1	-1.28	-0.14	2.97	0.48	1.54	-2.16	4.02	-19.65	0.95	0.74	2.27	0.85
P2	7.32	-1.59	-1.68	0.08	-0.21	3.24	5.37	4.35	0.40	0.24	7.27	-2.15
P3	-18.48	0.91	-0.43	-0.52	0.49	-7.21	-1.98	-45.65	-1.40	-0.41	-5.68	-0.15
P4	6.57	-0.39	2.07	-0.12	-0.16	2.34	-2.48	24.35	1.10	0.04	-0.73	3.90
P5	0.97	0.51	-2.18	0.18	-1.86	-5.16	-2.98	4.35	-2.10	-0.26	1.27	-0.15
P6	12.57	0.01	-0.48	0.03	0.64	4.99	-2.48	17.85	0.80	-0.06	-4.68	-2.15
P7	-7.68	0.71	-0.28	-0.12	-0.46	3.99	0.52	14.40	0.25	-0.26	0.27	-0.15

DFF: days to 50 % flowering; DM: days to maturity; MRL: main raceme length; NPB: number of primary branches; NSB: number of secondary branches; NSMR: number of siliquae on main raceme; NSP: number of siliquae per plant; PH: plant height; SL: siliquae length; SS: seeds per siliquae; TW: test weight; YPP: yield per plant.

Supplementary Table 5. Best general and specific combiner for 12 traits

Trait	Best general combiner	GCA effect	Best specific combiner	SCA effect
PH	P3	-18.48	P1 × P3	33.86
NPB	P3	0.91	P3 × P4	3.25
NSB	P1	2.97	P3 × P4	3.91
SL	P1	0.48	P3 × P4 / P3 × P7	1.05
SS	P1	1.54	P5 × P7	4.04
MRL	P6	4.99	P1 × P5	13.9
NSMR	P2	5.37	P5 × P6	8.99
NSP	P4	24.35	P3 × P4	161.91
YPP	P4	1.1	P5 × P6	5.1
TW	P1	0.74	P3 × P7	1.51
DFF	P3	-5.68	P3 × P4	9.04
DM	P2 / P6	-2.15	P2 × P6 / P3 × P6 / P6 × P7	5.33

Best general combiners were identified on the basis of desirable general combining ability (GCA) effects according to trait direction. For yield and most yield-related traits, higher positive effects were considered desirable, whereas for PH, DFF and DM, desirable negative effects were considered. DFF: days to 50 % flowering; DM: days to maturity; MRL: main raceme length; NPB: number of primary branches; NSB: number of secondary branches; NSMR: number of siliquae on main raceme; NSP: number of siliquae per plant; PH: plant height; SL: siliquae length; SS: seeds per siliquae; TW: test weight; YPP: yield per plant; GCA: general combining ability; SCA: specific combining ability.

Supplementary Table 6. Full correlation matrix

Trait	PH	NPB	NSB	SL	SS	MRL	NSMR	NSP	YPP	TW	DFF	DM
PH	1.00	-0.05	-0.30	0.02	-0.09	0.59	0.46	0.18	0.09	-0.17	0.06	0.16
NPB	-0.05	1.00	0.58	0.10	-0.27	0.08	0.29	0.62	0.10	-0.41	0.01	0.09
NSB	-0.30	0.58	1.00	0.14	-0.09	-0.07	0.19	0.51	0.38	0.04	0.24	0.24
SL	0.02	0.10	0.14	1.00	0.03	0.28	0.36	-0.04	-0.15	0.27	0.29	-0.06
SS	-0.09	-0.27	-0.09	0.03	1.00	0.20	0.06	0.04	0.30	-0.08	-0.26	-0.26
MRL	0.59	0.08	-0.07	0.28	0.20	1.00	0.69	0.34	0.29	-0.27	0.36	0.20
NSMR	0.46	0.29	0.19	0.36	0.06	0.69	1.00	0.50	0.39	-0.24	0.40	0.28
NSP	0.18	0.62	0.51	-0.04	0.04	0.34	0.50	1.00	0.72	-0.50	0.12	0.15
YPP	0.09	0.10	0.38	-0.15	0.30	0.29	0.39	0.72	1.00	-0.08	0.07	0.23
TW	-0.17	-0.41	0.04	0.27	-0.08	-0.27	-0.24	-0.50	-0.08	1.00	-0.06	-0.04
DFF	0.06	0.01	0.24	0.29	-0.26	0.36	0.40	0.12	0.07	-0.06	1.00	0.43
DM	0.16	0.09	0.24	-0.06	-0.26	0.20	0.28	0.15	0.23	-0.04	0.43	1.00

DFF: days to 50 % flowering; DM: days to maturity; MRL: main raceme length; NPB: number of primary branches; NSB: number of secondary branches; NSMR: number of siliquae on main raceme; NSP: number of siliquae per plant; PH: plant height; SL: siliquae length; SS: seeds per siliquae; TW: test weight; YPP: yield per plant.

Supplementary Table 7: Cluster-wise genotype composition and mean performance for 12 quantitative traits in 28 Indian mustard genotypes (Ward's hierarchical clustering, Fig. 13)

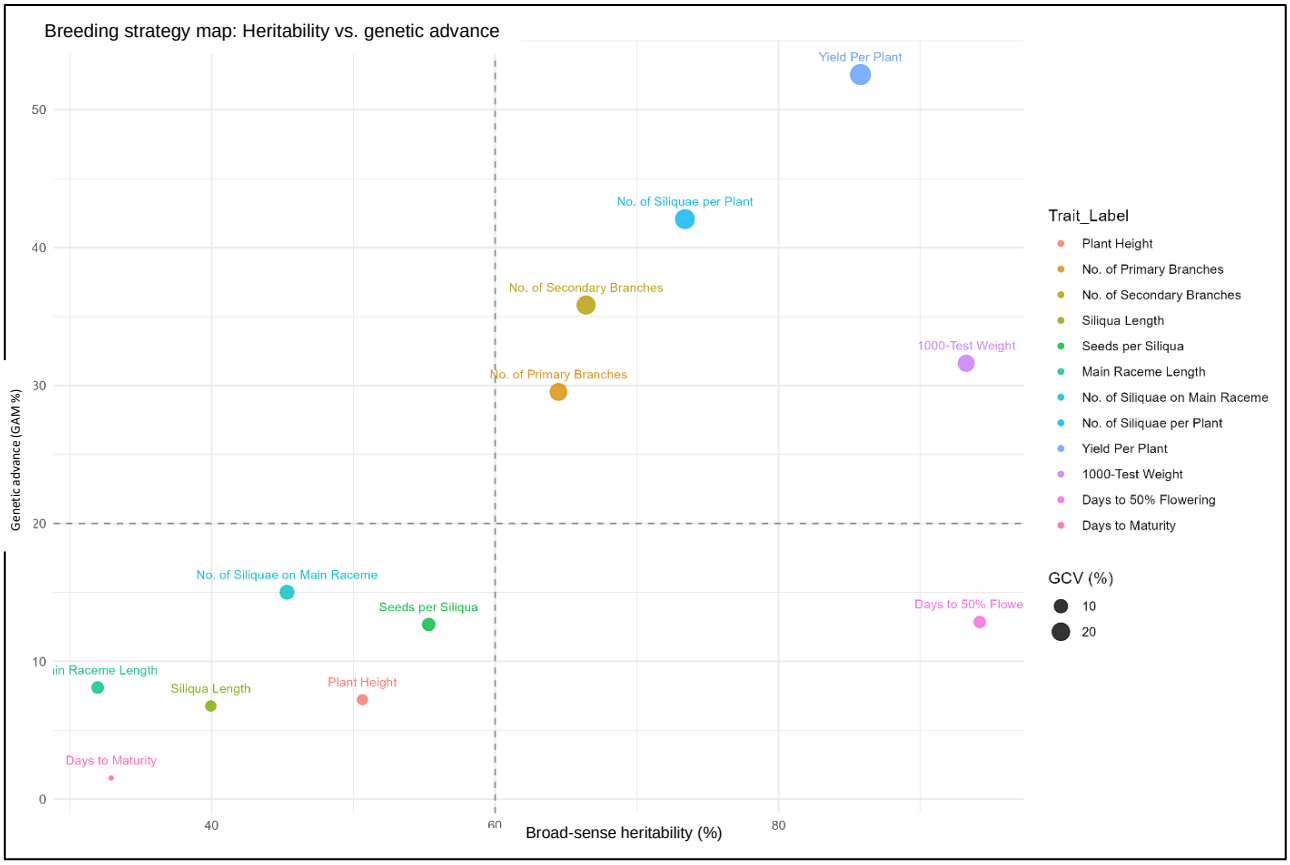
Table 7a. Cluster composition (genotype membership)

Cluster	Total genotypes	No. of hybrids	No. of parents	Genotypes included
I	5	5	0	H7, H15, H16, H2, H17
II	6	5	1	H19, H13, IC051151, H9, H5, H8
III	6	6	0	H21, H4, H1, H3, H14, H18
IV	11	5	6	RH1222-28, Varuna, Giriraj, EC597328, H12, RH749, H20, H11, EC676653, H6, H10

Table 7b. Cluster-wise mean values for twelve quantitative traits

Cluster	DFF	DM	PH	MRL	NPB	NSB	SL	SS	NSMR	NSP	YPP	TW
I	59.40	121.00	172.42	57.66	6.47	11.82	4.99	14.25	38.74	255.40	11.46	3.41
II	55.67	119.67	162.92	47.73	5.17	9.23	4.64	13.46	27.47	145.02	7.33	4.18
III	56.33	117.83	170.59	53.87	5.94	9.43	5.05	14.50	32.37	180.92	6.15	3.18
IV	60.45	120.82	172.69	56.01	5.22	9.78	5.15	13.08	34.55	159.23	7.16	4.03
Overall	58.36	119.96	170.10	54.07	5.59	9.95	4.99	13.68	33.31	178.01	7.75	3.77

DFF: days to 50 % flowering; DM: days to maturity; MRL: main raceme length; NPB: number of primary branches; NSB: number of secondary branches; NSMR: number of siliquae on main raceme; NSP: number of siliquae per plant; PH: plant height; SL: siliquae length; SS: seeds per siliquae; TW: test weight; YPP: yield per plant.



Supplementary Fig. 1. Relationship between broad-sense heritability and genetic advance among quantitative traits in Indian mustard.