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Research Note

Genetic variability analysis of yield and its components in *Brassica compestris var. toria*

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Abstract
The present study was carried out at the Research Farm of S.G. College of Agriculture and Research Station, Kumhrawand, Jagdalpur (C.G.), Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during Rabi 2013-14. Experimental materials comprised 30 F_1 from a 6 x 6 diallel crosses was grown in Randomized Complete Block Design with three replications with the objectives to estimate the genetic variability, heritability, genetic advance. Analysis of variance revealed presence of sufficient variability present as per different biometrical analysis except for days to maturity and oil content (%). Relative magnitude of phenotypic co-efficient of variation was higher than the genotypic co-efficient of variation. The high GCV and PCV were observed for only two traits viz. number of branches per plant and harvest index (%). The traits plant height (cm), siliqua length (cm), number of siliquae per plant and seed yield per plant had moderate GCV and PCV. The highest heritability estimates were observed for the traits erucic acid content followed by plant height, branches per plant, seed yield per plant, siliqua length, days to 50% flowering and harvest index (%). Genetic advance as percentage of mean was observed high for the character number of siliquae per plant, followed by seed yield per plant, days to maturity and plant height.

Key words
Brassica campestris, toria, seed yield, genetic variability

India is the fourth largest oilseed economy in the world. Among the seven edible oilseeds cultivated in India, rapeseed-mustard contributes 28.6% in the total oilseeds production and ranks second after groundnut sharing 27.8% of oilseed economy. Rapeseed-mustard group of oilseed crop is valued in terms of quantity and quality of the oil and protein of seed. Increasing oil content and improving the quality of oil and seed meal has been the major objectives of rapeseed mustard breeding programme in India as well as in world since long. Oil quality is determined by the nature and content of fatty acid. Erucic acid in oil of the Indian rapeseed mustard varieties is quite high (Chauhan *et al.,* 2011). The area, production and productivity of rapeseed-mustard in the world was 33.62 million ha, 61.4 million tons and 1815 kg/ha respectively during 2013–14. In India, production of 7.4 million tons from an area 6.3 million ha with an average productivity of 1176 kg/ha was recorded during 2013-14. (www.drmr.res.in).

Rapeseed mustard crops in India comprise traditionally grown indigenous species namely toria (*Brassica campestris L.var. toria),* brown sarson (*Brassica campestris* L. *var. brown sarson),* yellow sarson (*Brassica campestris L. var yellow sarson),* Indian mustard (*Brassica juncea* L. *Czern and Coss*), black mustard (*Brassica nigra)* and taramira (*Eruca sativa* Mill), which have been grown since about 3500 BC along with non-traditional species like gobhi sarson *(Brassica napus L.*) and Ethopian mustard or Karan rai (*Brassica carinata A. Braun)* (Chouhan *et al.* 2011). The rapeseed-mustard group is comprised of two distinct type (i) self pollinated – Indian mustard, raya and yellow sarson of which Indian mustard is the most important member of the group accounting 75-80 per cent of the area under rapeseed-mustard and (ii) cross pollinated – brown sarson, toria and taramira. In Chhattisgarh the productivity of toria is very low comparable to the national productivity and other state like Haryana (1609 kg), Gujrat (1577 kg), Rajshthan (1187 kg), Uttar Pradesh (1125 kg), Madhya Pradesh (1108 kg) etc. The reasons for low productivity of toria is due to the local genotypes which have low yielder, dwarf in nature, bushy or trailing habit and susceptible to alternaria blight, powdery mildew and aphids etc. This results in a big gap between requirement and production of rapeseed and mustard in Chhattisgarh and India. Hence, local genotypes of toria can be upgraded by crossing with improved varieties. This will lead to the higher yield and oil content in local genotypes of toria along with good adaptation. Hence, looking to above facts, the present investigation was carried out to study genetic variability parameters for yield and its components.

The present study was carried out at the Research Farm of S.G. College of Agriculture and Research Station, Kumhrawand, Jagdalpur (C.G.), Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). Experimental material comprised of 30 $\mathbf{F_1}$ (Reciprocal included) from a 6 x 6 diallel crosses involving six parents of toria was grown. Soil of the experimental site was *vertisol* and

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uniform in topography. The seeds of F_1 crosses, reciprocals and selfed parents were sown under a Randomized Complete Block Design with three replications in the *rabi* season 2013-14. Variability parameters were estimated as per the standard method (Johnson *et al*., 1955a; Burton, 1952; Hanson *et al*., 1956; Panse and Sukhatme, 1967).

The analysis of variance worked out for seed yield and its component in toria (Table 1) indicated that the mean sum of squares due to genotypes were significant for all characters. This is an indication of existence of sufficient amount of variability exist for most of the traits and low amount of variability for days to maturity and oil content in toria. This finding is conformation with the finding of Bhutto *et al.* (2006) Aytac and kinaki (2009), Doddadhimappa *et al.* (2010) and Jahan *et al.* (2014).

Genetic parameters of variation for seed yield and its components in toria are presented in Table 2. The overall mean and range for yield and its components revealed that there is substantial amount of genetic variability present for most of the characters under study in toria. Genetic parameters of variation are discussed character wise here as under.

Genotypic and Phenotypic coefficients of variation are simple measures of variability; these measures are commonly used for the assessment of variability. The relative values of coefficient give an idea about the magnitude of variability present in a genetic population. Thus, the components of variation such as genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were computed. The phenotypic coefficients of variation were marginally higher than the corresponding genotypic coefficient of variation indicated the influence of environment in the expression of the character under study.

Phenotypic coefficients of variation in general, were higher in magnitude than the genotypic coefficient of variation. The high GCV and PCV were observed for number of branches per plant (32.39%, 34.11%) followed by harvest index (26.94%, 31.41%). The moderate GCV and PCV was recorded for plant height (18.90%, 19.42%), siliqua length (16.71%, 17.92%), number of siliquae per plant (15.09% 20.46%), seed yield per plant (14.73%, 16.22%) and number of seeds per siliqua (10.94%, 13.11%) while, low GCV and PCV was observed for rest of the traits.

The high GCV as well as PCV were recorded for number of branches per plant followed by harvest index (%) number of siliquae per plant and seed yield per plant indicated that selection can be predicted to improve the toria genotypes through visual selection based on their phenotypes. Rest of the characters showed moderate to low coefficient of variability at genotypic and phenotypic levels, indicating presence of lower magnitude of variability. The estimates of GCV and PCV of the present study was closely in agreement with the Patel *et al.* (2006), Singh and Bhajan (2007), Mittal *et al.* (2007), Manohar and Sharma (2008), Dar *et al.* (2010) and Jahan *et al.* (2014).

Heritability governs the resemblance between parents and their progeny whereas; the genetic advance provides the knowledge about expected gain for a particular character after selection. Heritability suggests the relative role of genetic factors in expression of phenotypes and also acts as an index of transmissibility of a particular trait to its offspring's. However, the knowledge of heritability alone does not help in formulating concrete breeding programme. Genetic advance along with heritability helps to ascertain the possible genetic control for any particular trait. The nature and extent of the inherent ability of a genotype for a character is an important parameter determining the extent of improvement of any crop species. Heritability and genetic advance are the important genetic parameters for selecting a genotype that permit greater effectiveness of selection by separating out environmental influence from total variability.

In present investigation the high heritability was recorded for the character erucic acid content (96.80 %) followed by plant height (94.80%), branches per plant (90.20 %), seed yield per plant (89 %), siliqua length (87 %), days to 50% flowering (76.30 %) and harvest index (73.60 %). The moderate heritability was observed for the character number of seeds per siliquae (69.60 %) and number of siliquae per plant (54.40 %).

In the present study low heritability was observed for the character 1000 seed weight (43.10%), days to maturity (41.30%) and oil content (20.90%). The heritability value alone however, provides no indication of the amount of genetic improvement that would result from selection of superior genotypes. To facilitate the comparison of progress in various characters of different genotypes, genetic advance was calculated as percentage of mean.

Genetic advance as percentage of mean was observed high for the character number of siliquae per plant (61.28 %), followed by seed yield per plant (42.90 %), days to maturity (42.04 %) and plant height (26.26 %). Genetic advance as percentage of mean was recorded as low for the character *viz.* days to 50% flowering (4.08 %) followed by number of branches per plant (3.28 %), erucic acid content (3.26 %) seeds per siliqua (2.45 %), harvest index (1.88 %), siliqua length

(1.27 %), oil content (0.47 %) and 1000 seed weight (0.31 %).

Heritability estimates were high for the characters erucic acid content, plant height (cm), branches per plant, seed yield per plant, siliqua length, days to 50% flowering and harvest index, whereas it was high along with genetic advance as percentage for number of siliquae per plant, seed yield per plant, days to maturity, number of plants per plot and plant height (cm). High heritability along with high genetic advance indicated predominance of additive gene action in expression of these characters. Therefore, phenotypic selection on the basis of these traits may be effective for yield improvement. These results are in agreement with the findings of Patel et al. (2006), Akbar *et al.* (2007), Shrivastava (2007), Manohar and Sharma (2008), Aytac and Kinaki (2009), Keer and Jakhar (2012) and Jahan *et al.* (2014).

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Table 1. Analysis of variance for seed yield and its component in toria at Jagdalpur (C.G.)

Source of variation	df	PH	DFF	NBP	SL	NSP	NSS	DM	TSW	HI	SOC	EAC	SYP
Replication	2	49.20*	1.01	0.05	0.06	450.50	1.01	8.69	0.24*	0.17	0.09	0.23	4.26
Treatment	35	523.81**	17.02**	8.76**	1.37**	6304.40*	6.97**	10.10**	0.23*	3.80**	1.67*	7.84**	15.22**
Error	70	9.45	1.60	0.31	0.07	1376.65	0.89	3.25	6.92	0.41	0.93	0.08	6.02

*, **, Significant at 5 and 1 per cent levels, respectively

Table 2. Genetic parameters of variation for seed yield and its component in toria at Jagdalpur, (C.G.)

S. No.	Character	Mean	Range		PCV (%)	GCV (%)	Heritability	Genetic Advance (%)
			Max.	Min.				
1	PH	69.27	89.07	32.64	19.42	18.90	94.8	26.26
2	DFF	31.04	35.67	25.67	8.37	7.31	76.3	4.08
3	NBP	5.18	8.40	2.33	34.11	32.39	90.2	3.28
4	SL	3.94	5.70	2.73	17.92	16.71	87.0	1.27
5	NSP	268.52	374	190	20.46	15.09	54.4	61.28
6	NSS	13.02	17.67	10.67	13.11	10.94	69.6	2.45
7	DM	86.18	89.33	82.67	2.73	1.75	41.3	42.04
8	TSW	2.48	2.94	1.79	14.01	9.19	43.1	0.31
9	HI	3.94	6.13	2.26	31.41	26.94	73.6	1.88
10	SOC	40.64	42.6	39.23	2.67	1.22	20.9	0.47
11	EAC	48.39	45.13	51.58	3.38	3.32	96.8	3.26
12	SYP	13.81	10.26	19.37	16.22	14.73	89.0	4.20

PH	Plant height (cm)	DFF	Days to 50% flowering	NBP	Number of Branches per plant
SL	Siliqua length (cm)	NSP	Number of Siliquae per plant	NSS	Number of seeds per siliquae
DM	Days to maturity	TSW	1000 seed weight (g)	HI	Harvest index (%)
SOC	Seed oil content (%)	EAC	Erucic acid contents (%)	SYP	Seed Yield per plant (g)