

## MORPHO-PHYSIOLOGICAL EVALUATION OF TURNIP

Chandreshwar Prasad and Mina Shrivastava<sup>1</sup>

Cytogenetics Laboratory, Post-Graduate Department of Botany,  
St. Columba's College, Hazaribag 825 301 (Bihar)

**Key words :** Turnip, characterization, fertilization value, pollen fertility

Although morphological characteristics of some Indian varietal populations of turnip are known to some extent (Williams, 1985; Shrivastava, 1992), they are not well studied. Therefore, one of the objectives of the present work was to characterize and evaluate seven populations of turnip on the basis of their morphophysiological characteristics. The populations which constituted the material for present investigation are : Blue White (BW), Rose Red (RR), Purple Top White (PT), Moddle White (MW), Golden Ball (GB), Early Snow Ball (SB), and Green Globe (GG). To make comparative study the plants were raised from the seeds in controlled condition in rows at a distance of 35-40 cm during September-April, 1988-1989 in the field at Hazaribag. Following characteristics were taken into consideration : per cent seed germination (PSG), seedling morphology which included the mean hypocotyl length (MHL), mean cotyledon area (MCA) and relative width of cotyledon (RWC %): number of leaves/plant (MNL), lobes/leaf (MNLB), number of branches/plant (MNB), plant height (Ph), days to flower, mean number of stomata/unit area (MNT), number of chloroplasts/guard cell (MNC), mean number of ovules/pistil (MNO), mean number of seeds/siliquae (MNS), fertilization value (FV %) and pollen fertility.

PSG is based on 1000 seeds in each population. MHL was obtained from measurement of 100 randomly selected seedlings after the appearance of the first true leaf. At the same time, length and width of the cotyledons were also measured with the help of a divider and a scale in order to calculate MCA. MNLB was computed by counting the number of lobes in ten leaves from each of 25 plants. To score MNB number of secondary branches developing from the main axis was counted. Days to flower were scored as appearance of first flower from sowing. Total 625 pistils, (25 from each plants of 25 plants

---

Present address : <sup>1</sup>Department of Botany, Annada College, Hazaribag 825 301 (Bihar)

in each population were dissected out carefully to score MNO. MNS was scored by counting the number of seeds in 250 siliquae (10 from each plant of the 25 plants). The ratio of MNS to MNO gave FV. For pollen fertility, technique of John Ferreira (1985) was used considering about 1000 pollen grains in each population.

The populations showed inter-population variation in various characters. Studied (Table 1). Turnip is suitable for genetical study of the seedling characters (Prasad & Shrivastava, 1993 b) which are quite sharp and distinct in this species. The seedling counts give better genetic ratio than the adult plant counts due to lesser effect of the environment on such characters. The data of present investigation demonstrated that the populations of turnip differed considerably among themselves in PSC, MHL, MCA and RWC due to their genotypic peculiarities. The populations having greater MHL had smaller MCA and vice-versa (Prasad, 1993 a). This indicated that MHL is negatively correlated with MCA. Whether hypocotyl length has any correlation with root size in turnip is not known. However, SB, GB and PT characterized by the larger roots also had the longer hypocotyl (Shrivastava, 1992).

Our results also demonstrated that different populations of turnip vary among themselves in the vegetative attributes like MNL, MNLB, MNT, MNC, Ph and MNB. Whether these parameters have any relation with the components of fertility in turnip is not known.

The populations differed in fertility components as well. It is remarkable that FV in all the population is below 50%. The seed set in turnip appears to be a genotypic function of the (Prasad & Shrivastav, 1993c). The pollen fertility in these populations also showed significant intervarietal differences. In contrast to the fertilization value, pollen fertility in all the populations is quite high, above 84.0 per cent. Some sort of prallelism does exist between pollen fertility and meiotic chromosome behaviour (Shrivastava, 1992) but this can hardly be generalised. However, in radish a correlation between pollen sterility and meiotic chromosome abnormalities have been noted (Dayal, 1978). Nwankiti (1970) is of the opinion that all types of chromosome abnormalities are not related with pollen sterility.

Thus the present study shows that the populations of turnip vary genotypically among themselves in a number of morphophysiological attributes. Heterosis has been a phenomenon of great interest to plant breeders and the degree of heterosis is closely associated with genetic diversity of the parental forms and, therefore, intervarietal hybridization becomes more significant from the viewpoint of effective exploitation of additive and non-additive genetic variability.

Table 1. Variations in morpho-physiological traits in the varietal populations of turnip

Characteristics	BW		RR		PT		MW		CB		SB		GC	
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE							
1. % Seed Germination (PSG)	52.0 ± 1.57	73.3 ± 1.39	56.1 ± 1.57	59.4 ± 0.96	61.1 ± 1.47	70.2 ± 1.44	57.9 ± 1.56	63.0 ± 1.52						
2. mean Hypocotyl length (MHL) (mm)	55.8 ± 1.17	35.2 ± 0.76	59.4 ± 0.96	58.5 ± 0.02	28.6 ± 0.86	63.9 ± 1.07	63.9 ± 1.04	28.7 ± 0.84						
3. Mean Cotyledon area (MCA) mm <sup>2</sup>	46.7 ± 0.02	82.5 ± 0.03	58.5 ± 0.02	58.5 ± 0.02	79.6 ± 0.04	51.8 ± 0.02	53.8 ± 0.02	82.5 ± 0.03						
4. Relative width of cotyledons (RWC) %	143.0 ± 1.92	154. ± 2.85	163.3 ± 2.08	163.3 ± 2.08	130.8 ± 3.91	126.6 ± 1.96	131.2 ± 2.21	146.7 ± 3.42						
5. Mean No. of leaves/plant (MNL)	13.0 ± 0.89	9.4 ± 0.76	10.6 ± 0.58	10.6 ± 0.58	11.2 ± 0.58	10.4 ± 0.62	10.2 ± 0.59	10.8 ± 0.72						
6. No. of lobes/leaf (MNLB)	16.6 ± 0.96	9.6 ± 0.62	11.2 ± 0.58	11.2 ± 0.58	12.0 ± 0.69	13.4 ± 0.73	11.4 ± 0.66	12.0 ± 0.69						
7. Mean No. of branches/plant (MNB)	1.6 ± 1.14	11.4 ± 0.77	11.2 ± 0.64	11.2 ± 0.64	9.0 ± 0.34	11.0 ± 0.85	9.2 ± 0.44	-						
8. Plant height (Ph) (cm)	109.6 ± 4.81	105.6 ± 4.60	82.4 ± 6.0	82.4 ± 6.0	80.8 ± 4.59	85.6 ± 4.45	68.8 ± 4.53	-						
9. Days to flower	80	72	73	73	137	181	176	Did not flower even after 180 days						
10. No. of stomata/unit area (MNT)	15.5 ± 0.98	16.3 ± 0.48	15.9 - 0.57	15.9 - 0.57	28.0 ± 0.82	12.6 ± 0.41	20.6 ± 0.65	15.6 ± 0.37						
11. No. of chloroplasts/guard cell (MING)	4.4 ± 0.10	3.9 ± 0.10	3.7 ± 0.10	3.7 ± 0.10	3.2 ± 0.08	3.5 ± 0.11	3.3 ± 0.10	3.6 ± 0.11						
12. No. of ovules/pistil (MNO)	23.1 ± 0.24	22.1 ± 0.31	21.3 ± 0.23	21.3 ± 0.23	22.7 ± 0.30	27.3 ± 0.23	16.5 ± 0.29	-						
13. No. of seeds/siliquae (MNS)	5.3 ± 0.23	7.8 ± 0.41	7.9 ± 0.28	7.9 ± 0.28	8.9 ± 0.22	11.6 ± 0.24	5.2 ± 0.22	-						
14. Fertilization value (FV%)	23.5 ± 1.34	36.9 ± 1.52	37.9 ± 1.52	37.9 ± 1.52	40.7 ± 1.55	41.7 ± 1.55	31.3 ± 1.47	-						
15. Pollen Fertility (%)	85.5 ± 1.10	90.8 ± 0.91	87.8 ± 1.03	87.8 ± 1.03	84.2 ± 1.15	85.6 ± 1.11	83.4 ± 1.17	-						

## REFERENCES

- Dayal, N. 1978. In breeding depression and heterosis in chromosome behaviour of radish. *Curr. Sci.* 48 : 125-127
- Ferreira, J. 1985. Pollen viability tests for *Brassica*. In 'CRGC Resource Book' (ed. P.H. Williams), Wisconsin, USA.
- Nwankiti, O. 1970. Cytogenetic and breeding studies with *Brassica*. I. Cytogenetic experiments with *brassica napocampestris*. *Hereditas* 66 : 109-126.
- Prasad, C. 1993a. Genetical and evolutionary significance of some juvenile and other vegetative attributes in turnip (*Brassica rapa* L.) *Bionature* 13 (2): (In press).
- Prasad, C and M. Shrivastava. 1993b. Inheritance of hypocotyl length and root colour in turnip. *Geobios new Reports.* 12 : 164-167.
- Prasad, C and M. Shrivastava. 1993c. Study of fertility in the varietal populations of turnip and their hybrids. Proc. VIII All India Congr. Cytol. Genet., Berhampur (Orissa), p.1.
- Shrivastava, M. 1992. Cytogenetic investigations in turnip. Ph.D. Thesis, Ranchi University, Ranchi.
- Williams, P.H. (ed) 1985. Cr. GC Resource Book, Wisconsin, USA.