Comparative Analysis of Variability in Two Ecotypes of Indian Rapeseed (*Brassica campestris* L. var. *Yellow* and *Brown Sarson*)

SK Yadav, AK Shukla, JS Chauhan, AK Singh and PR Kumar
National Research Centre on Rapeseed-Mustard, Sewar, Bharatpur-321303, Rajasthan

One hundred and fifty germplasm accessions of two ecotypes of Indian rape (*Brassica campestris* L.) namely var. brown sarson (90 accessions) and var. yellow sarson (60 accessions) were characterized for 10 agro-morphological traits. Wide range in means were observed in the two ecotypes. The accessions of brown sarson matured one week earlier and also had slightly less height than that of yellow sarson. Mean secondary branches/plant, seeds/siliqua and 1000 seed weight were higher in yellow sarson ecotype than that of brown sarson. Irrespective of the group, oil content (CV 2.7-2.9%) and plant height (CV3.7-4.1%) had the lowest variation whereas, primary branches/plant (CV 27.0-35.9) and secondary branches/plant (CV 38.4-49.1%) the highest. The useful accessions for different agro-morphological traits were identified from both the ecotypes. The pattern of grouping is presented and 10 accessions with high oil content (≥45%) are also listed and characterized.

Key Words: ***Brassica campestris* var. *yellow sarson* and *brown sarson*, Germplasm, Oil Content**

Rapeseed (*Brasica campestris* L.) is an important oilseed crop among the major edible oilseeds. There are there ecotypes of *B. campestris*, namely var. toria, var. yellow sarson and var. brown sarson. Although var. brown and yellow sarson are cultivated on a limited scale in certain pockets of Jammu and Kashmir, Assam, Bihar, West Bengal, Himachal Pradesh and Haryana. Owing to earliness and high oil content they have good scope of spreading if high yielding varieties are available. Large number of accessions of brown and yellow sarson were available at the Project Coordinating Unit (Kumar, 1987) which were later shifted to National Research Centre on Rapeseed-Mustard, Bharatpur. With a view to find out their potential, 150 germplasm accessions were characterized for 10 agro-morphological traits in the present investigations.

Materials and Methods

One hundred fifty accessions of *Brassica campestris* L. var. yellow sarson (60) and brown sarson (90) were grown in augmented design during *rabi* season of 1995-96 at National Research Centre on Rapaseed-Mustard, Bharatpur. Each accession was sown in two rows of 5 m with the spacing of 15 cm and 30 cm plant-to-plant and row-to-row, respectively. Recommended dosages of fertilizers (N and P @ 80:17 kg/ha) were applied. Half of the nitrogen (40 kg/ha) and full dose of phosphorus were applied at the time of sowing while remaining half of the nitrogen (40 kg) was top dressed just after first irrigation (40 days after sowing). Suitable agronomic practices and plant protection measures were followed as and when needed.

Observations were recorded on five competitive randomly chosen plants. The characters studied were days to maturity, plant height (cm), primary branches/plant, secondary branches/plant, main shoot length (cm), siliquae on main shoot, siliqua length (cm), seeds/siliqua, 1000-seed weight (g) and oil content (%).

An electronic seed counter ("L" System Old Mill Co. USA) was used for counting 1000-seeds and the oil content (%) was analysed by Nuclear Magnetic Resonance (Oxford 5000). Range, mean and coefficient of variations (CV) computed separately for brown and yellow sarson accessions. The accessions were grouped following appropriate class intervals.

Results and Discussion

To adopt in the multiple cropping production system, the varieties of appropriate plant height such as short height and early maturity are highly desirable for mixed cropping. Indian rape accessions are of relatively early- to mid-early duration as compared to other oleiferous *Brassica* crops. Both the ecotypes, *viz.*- brown sarson and yellow sarson had similar extent of variability for plant height (Table 1). Plant height ranged from 138 to 218 and 115 to 193 cm, in yellow sarson and brown sarson, respectively. The mean plant height of yellow sarson accessions was slightly more than that of brown sarson. Thirty two accessions of yellow sarson had plant height of ≤ 155 cm whereas in the brown sarson, majority of the accessions (63.3%) fell between 156-175 cm (Fig. 1a). In the present investigation, 56.7% of the brown sarson and 5% of yellow sarson accessions matured during less than 120 days. In general, yellow sarson accessions matured later than those of brown

sarson (Fig. 1b). Although, yellow sarson exhibited wider range of maturity than brown sarson, the overall variability was low (CV 3.7-4.1%). Accessions having early duration (≤ 120 days) and short plant height (137-160 cm) have also been identified (Table 2).

Main shoot length and siliquae on main shoot have been reported to have high heritability hence very useful in the selection of high yielding genotypes. Range and mean shoot length of the yellow sarson collection were slightly more than those of brown sarson (Table 1). The

Table 1. Range, mean and coefficient of variation (CV) for various economically important characters of yellow and brown sarson

Character	Ecotypes	Range	Mean ± S.Em.	CV(%)
Maturity (Days)	Yellow sarson	117 (YSPG 843) -140 (YSC 21)	129.9 ± 0.7	4.1
	Brown sarson	116 (BSC 45) - 132 (BSC 152)	121.3 ± 0.5	3.7
Plant height (cm)	Yellow sarson	138 (PYS 386) - 218 (YSC 18)	174.4 ± 1.5	8.4
	Brown sarson	115 (BSC 51) - 193 (BSC 64)	164.1 ± 1.5	8.5
Primary branches/plant	Yellow sarson	4.0 (YSC 28) - 18.0 (SSK92-16)	8.0 ± 0.4	35.9
	Brown sarson	3.8 (BSC 68) 16.2 (BSC 46)	8.3 ± 0.2	27.0
Secondary branches/plant	Yellow sarson	2.0 (PYS 286) 14.6 (YSC 10)	8.0 ± 0.4	38.4
	Brown sarson	2.5 (BSC 80) 16.6 (BSC 46)	5.8 ± 0.3	49.1
Main shoot length (cm)	Yellow sarson	55.8 (PYS 386) 89.6 (YSC 31)	72.8 ± 1.1	12.0
	Brown sarson	37.4 (BSC 71) 82.2 (BSC 97)	67.3 ± .09	12.5
Siliquae on main shoot	Yellow sarson	32.0 (YSC 27) 51.2 (YSC 20)	41.4 ± 0.6	11.7
	Brown sarson	19.0 (BSC 46) 83.6 (BSC 98)	41.4 ± 0.8	18.9
Siliqua length (cm)	Yellow sarson	3.9 (YSPG 187) 6.4 (YSC 36)	5.4 ± 0.1	9.2
	Brown sarson	4.2 (BSC 56) 6.7 (BSC 147)	5.4 ± 0.1	10.6
Seeds/siliqua weight (g)	Yellow sarson	15.6 (YSC 22) 44.6 (YSPG 387)	24.0 ± 0.8	25.0
	Brown sarson	12.2 (BSC 81) 23.4 (BSC 73)	19.1 ± 0.2	10.2
1000-seed weight (g)	Yellow sarson	4.0 (YSC 35) 6.9 (SSK 6)	5.3 ± 0.1	13.2
	Brown sarson	3.1 (BSC 73) 5.9 (BSC 139)	4.7 ± 0.1	11.5
Oil content (%)	Yellow sarson	41.0 (YSC 54) 47.0 (YSC 32)	44.2 ± 0.2	2.9
	Brown sarson	40.5 (BSC 133) 45.9 (BSC 63)	43.5 ± 0.1	2.7

Table 2. Useful donors for various characters of yellow and brown sarson

Character	Crop	Promising accessions
Maturity (days)	Brown sarson	BSC 45 (116), BSC 48 (116), BSC 66 (116) BSC 92 (116) BSC 53 (117).
	Yellow sarson	YSPG 843 (117), SSK 13 (118), YSC 9 (120), YSPG 847 (121), YSC 11 (122).
Plant height (cm)	Brown sarson	BSE 51 (115.2), BSC 46 (116-6), BSC 148 (141.4), BSC 69 (144.4), BSC 121 (149.4).
	Yellow sarson	PY 386 (137.8), YS 13 (145.2), YSC 20 (158.0), YSPG 287 (159.0), YSCN 7 (159.2).
Primary branches/plant	Yellow sarson	YSCN 2 (18.0), SSK 92-16 (18.0), YSC 10 (14.6), YSC21 (1 3.6),YSC 6 (12.6).
	Brown sarson	BSC 46 (16.2), BSC 47 (14.0), BSC 140 (13.6), BSC 129 (11.8), BSC 114 (10.4).
Secondary branches/plant	Yellow sarson	YSC 10 (14.6), YSC 34 (10.8), YSC 53 (10.7), YSC 50 (10.6), YSC 27 (10.4).
	Brown sarson	BSC 46 (16.6), BSC 123 (14.7), BSC 129 (11.5), BSC 150 (9.8), BSC 124 (9.7).
Main shoot length (cm)	Yellow sarson	YSC 31. (89.6), YSC 32 (85.6), YSC 26 (84.4), YSC 10 (84.0), YSC 36 (83.2).
	Brown sarson	BSC 97 (82.2), BSC 78 (81.5), BSC 76 (81.2), RSC 80 (81.2), BSC 90 (80.4).
Siliquae on main shoot	Yellow sarson	YSC 20 (51.2), YSCN 2 (50.2), YSPG 387 (50.2), YSC 10 (50.0), YSC 442 (50.0).
	Brown sarson	BSC 98 (83.6), BSC 85 (79.8), BSC 87 (79.4), BSC 84 (74.2), BSC 99 (71.0).
Siliqua length (cm)	Yellow sarson	YSC 36 (6.4), YSC 43 (6.2), YSC 44 (6.2) YSC 53 (6.2), YSC 39 (6.1).
	Brown sarson	Bse 147 (6.7), BSC 121 (6.2), BSC 122 (6.2), BSC 136 (6.2), BSC139 (6.2).
Seeds/siliqua	Yellow sarson	YSPG 387 (44.6), PYS 286 (43.6), PYS 386 (40.0), YSPG 186 (37.0), YSPG 847 (33.6).
	Brown sarson	BSC 73 (23.2), BSC 80 (23.2), BSC is (21.6), BSC66 (21.2), BSC 53 (21.0).
1000-seed weight (g)	Yellow sarson	SSK 6 (6.9), YSC 9 (6.8), YSC 50 (6.0), YSC 51 (6.0), YSC-27 (6.0).
	Brown sarson	BSC 139 (5.9), BSC 147 (5.8), BSC 50 (5.8), BSC 140 (5.7), BSC 145 (5.6).
Oil content (%)	Yellow sarson	YSC 32 (47.0), YSC 10 (46.3), YSC 31 (46.2), YSPG 8143 (45.8), YSC 21 (45.7).
	Brown sarson	BSC 63 (45.9), BSC 92 (45.8), BSC 78 (45.4), BSC 155 (45.2), BSC 61 (45.1).

Mean values are in parentheses

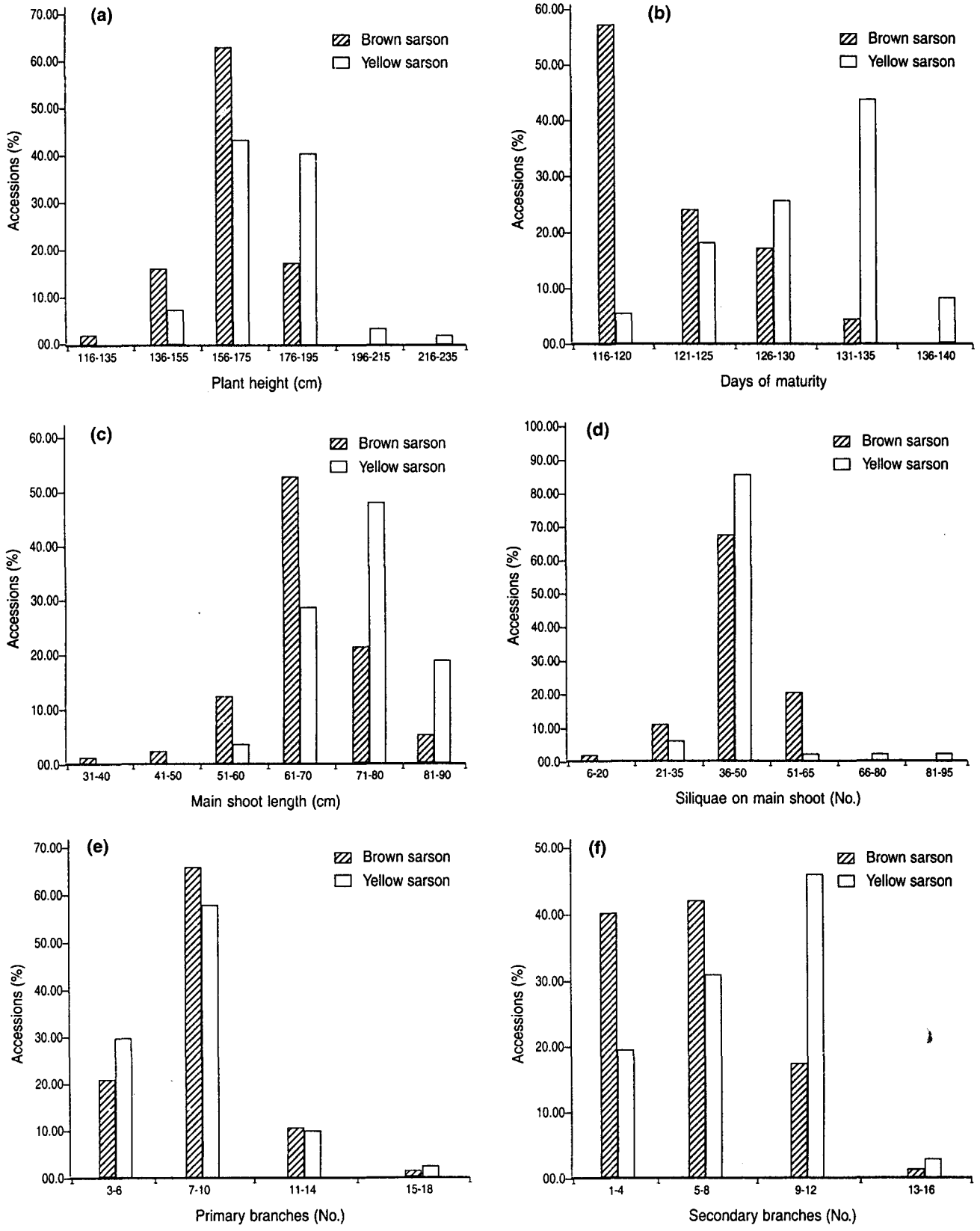

Fig. 1a-f. Classification of brown sarson and yellow sarson germplasm accessions based on (a) plant height, (b) days to maturity (c) main shoot length, (d) siliquae on main shoot, (e) primary branches (f) secondary branches

difference between variability in the two collections was not significant. Siliquae on main shoot varied more in brown sarson collections (CV 18.9%) than in yellow sarson (CV 11.7%). Kumar and Yadava (1978) also reported substantial variability in Indian colza. However, there was no difference for siliquae on main shoot (Table 1). The grouping of accessions based on main shoot length (Fig. 1c) revealed that 44.4% and 43.3% of the accessions had ≥ 70 cm long main shoot in brown sarson and yellow sarson collections, respectively. In general, most of the accessions (86.7%) of the yellow sarson collection had siliquae on main shoot ranging from 26-35 (Fig. 1d) whereas siliquae density (siliquae/cm) appeared more in brown sarson collection where (64.4%) accessions grouped in the range of 36–50 siliquae. Further 17 accessions (18.9%) had more than 50 siliquae on the main shoot (Fig. 1d). Accessions with long main shoot and high siliquae on main shoot are listed in Table 2.

In contrast to all the other characters studies, branches/plant and secondary branches/plant varied significantly within different accessions in both the groups (Table 1). Of the two, primary branches/plant had higher variation in yellow sarson collection whereas it was secondary branches/plant in brown sarson which showed higher variability (Table1). Similarly, Yadava *et al.*, (1985) reported high variability for primary branches/plant in brown sarson. The mean in general, was similar for both the collections for primary branches/plant whereas in brown sarson collection secondary branches/plant was less as compared to that of yellow sarson The grouping of the accessions on the basis of primary branches/plant and secondary branches/plant has been depicted in Figs. 1e and 1f. Only two accessions, one each from brown sarson (BSC 46) and yellow sarson (SSK 92-16) had very high number of primary branches/plant (≥14) and three accessions had high number of secondary branches (13-16), *viz.*- BSC 46, BSC 123 and YSC10 (Table 2).

Siliqua length ranged from 3.9 (YSPG 187) to 6.4 (YSC 36) and 4.2 (BSC 56) to 6.7 cm (BSC 147), respectively in yellow sarson and brown sarson ecotypes. Mean siliqua length in both ecotypes was similar, though brown sarson collection had slightly higher variability (Table 1). Most of the accessions of yellow sarson (41, 68.3%) had siliqua length in the range of 5.1-5.5 cm whereas 65.6% of the brown sarson accessions (59) were grouped in the range of 5.5-6.0cm (Fig 1g). Five accessions of each ecotype showed siliqua more than 6 cm (Table 2).

The yellow sarson collection exhibited higher range, mean and coefficient of variation for seeds/siliqua as compared to that of brown sarson (Table 1). Most of the brown sarson accessions (72) had less than or equal to 20 seeds/siliqua while 12.2% (11) showed 21-25 seed/siliqua whereas 7 accessions of yellow sarson had more than 25 seeds (Fig. 1h).

Bold-seeded varieties are the preferred ones. This character had moderate variability (CV 11.5-13.2%). Yellow sarson collection exhibited slightly higher mean

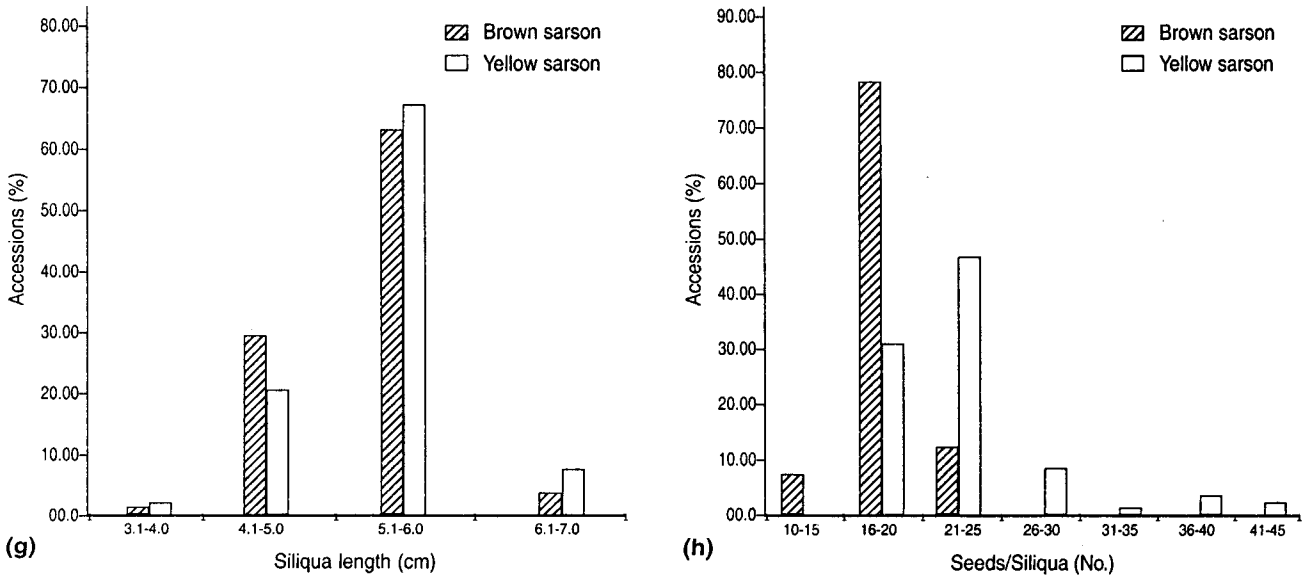

Fig. 1g-h. Classification of brown sarson and yellow sarson germplasm accessions based on (g) siliqua length, (h) seeds/siliqua

(Table 1). Five accessions of yellow sarson exhibited high seed weight of 6 g (Table 2) whereas in brown sarson, the highest seed weight was 5.9g (BSC 139). Sixty one accessions (67.8%) of brown sarson showed 1000-seed weight ranging from 4.1-5.0 g while 61.6% (37) of the yellow sarson accessions showed a range of 5.1-6.0g (Fig. 1i).

Oil yield determines the commercial success of the variety. Among all the characters, irrespective of the ecotypes, oil content varied the least (CV 2.7-2.9%). The oil content varied from 41-47 and 40.5-45.9% respectively in the yellow sarson and brown sarson ecotypes. YSC 32 of yellow sarson and BSC 63 of brown sarson had the highest oil content (Table 1). There was marginal increase in mean oil content of yellow sarson accessions. The agro-morpholigical characters of 10 top high oil yielding accessions are presented (Table 3). Fifty two accessions (57.7%) among the brown sarson

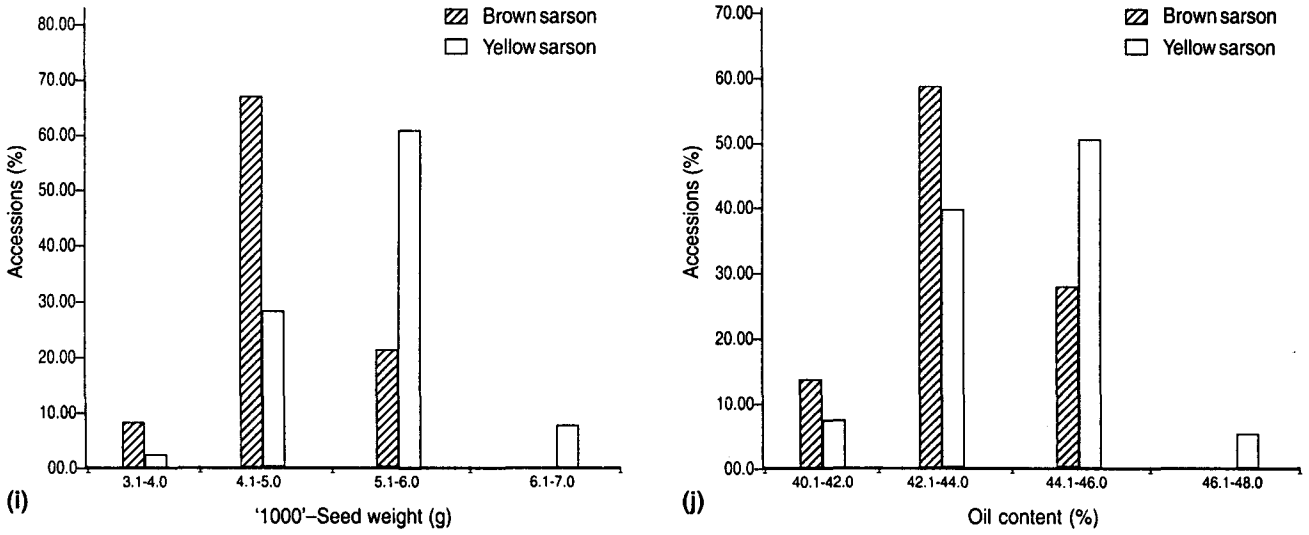

Fig. 1i-j Classification of brown sarson and yellow sarson germplasm accessions based on (g) siliqua length, (h) seeds/siliqua

Table 3. Characters of yellow and brown sarson accessions having high oil content

Genotype	Oil (%)	Maturity (days)	Plant (cm)	Primary plant	Secondary plant	Siliquae on main shoot	Siliqua (cm)	Seeds/ siliqua	1000-seed seed
YSC-32	46.9	129	190	6	4.2	44	5.1	20	5.6
YSC-10	46.3	119	182	12	14.6	50	5.0	18	5.6
YSC-31	46.2	130	200	10	3.0	49	4.7	22	5.5
YSPG-8143	45.8	117	171	10	8.5	40	4.9	27	4.1
YSC-21	45.7	140	163	6	3.6	37	5.1	20	5.6
BSC-63	45.9	118	154	12	5.0	31	5.7	21	4.4
BSC-92	45.8	116	176	5	3.8	39	4.8	20	3.8
BSC-78	45.4	130	171	8	3.5	52	4.8	20	4.3
BSC-155	45.2	122	154	8	6.0	34	5.9	20	4.4
BSC-61	45.1	121	156	7	3.8	40	5.1	19	48

collection had oil content in the range of 43-44% whereas 25 had a range of 45-45.9%. Three accessions of yellow sarson *viz.* YSC 32, YSC 10 and YSC 31 had more than 46% oil content (Fig. 1j).

Several useful accessions possessing desirable agro-morphological characters and oil content were identified in the present collections which could serve as an important genepool for the hybridization programme to improve yield and oil content *Brassica* species.

Referances

Kumar PR (1987) Genetic Resources Activities in oil seed Brassicae pp: 201-209. In: RS Paroda, RK Arora and KPS Chandel (eds.) *Plant Genetic Resources: Indian Perspective,* National Bureau of Plant Genetic Resources, New Delhi.

Kumar PR and TP Yadava (1978) Genetic variability and interactions of agronomic traits in Indian Colza. *Proc. 3rd All India Cong. Cytol. Cytogenet.* Oct. 23-28, pp 10.

Yadava N, PR Kumar and RK Behl (1985) Genetic variability and selection indices in brown sarson. *Crucifer Newslett.* **7:** 62-63.