

STUDIES ON CLASSIFICATION AND FREQUENCY DISTRIBUTION FOR DIFFERENT CHARACTERS IN LINSEED GERMPLASM (*Linum usitatissimum* L.)**KAILASH RAM¹**

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ABSTRACT

An experimental field was carried out at the Main Experimental Form, N.D. Univ. of Agri. And Tech., Kumarganj, Faizabad in the rabi season. The frequency distribution under the ten matric traits for 440 linseed germplasm were studied. Only two types of flower colour such as blue and white were observed in all the germplasm lines. The each of the traits viz. days to 50% flowering, days to maturity, PDI (AB) on leaves, plant height (cm), number of secondary branches per plant, number of capsules per plant, seed yield per plant (g) and 1000- seed weight (g) were grouped into 10 classes, while number of primary branched per plant and number of seeds per capsule were grouped into 5 classes. The maximum number of germplasm lines along with traits 161 (DM), 108 (PH), 273 (NPB/P), 162 (NSB/P), 221 (NC/P), 181 (S/C), 158 (SY/P) and 115 (1000-SW) were in the class ranges of 127.10-129.50, 51.86-57.83, 1.55-3.64, 5.65-8.79, 10.30-24.13, 7.38-8.44, 2.05-3.36 and 4.89-4.46, respectively, which accounted 36.59, 24.55, 62.05, 36.82, 50.23, 41.14, 35.90 and 26.14 per cent of the frequencies, respectively. These studies indicate to a vast variability within the linseed germplasm lines. Therefore, it may be useful to selected superior parental lines for the improvement of linseed crop through breeding programme.

KEYWORDS: Classification, Characterization, Frequency Distribution, Linseed

Linseed is belonging to family Linaceae. The chromosome number of the cultivated species, *Linum usitatissimum* L., is $2n=30$ and varies from 16 to 86 in the other species. The petal size in linseed observed greater variability in germplasm by Mozkova *et al.* (2006) Every part of the linseed plant is utilized commercially, either directly or after processing. On a very small scale, the seed is directly used for edible purposes and about 80 per cent of the oil goes to industries for manufacture of paints, varnish, oil-cloth, etc. In India, Russia and some other countries, the oil extracted from unheated seeds is used for food purposes. Recent discoveries for the use of linseed oil in the process of cementing of roads in the USA (Walsh, 1965) and in antibiotics (Anonymous, 1968) have given it a new importance. According to Joshi and Dhawan (1986), germplasm diversity is essential for achieving various crop objectives such as increasing yield wider adaptation, desirable quality and disease resistance. To understand the adaptability, the domestication of linseed, it is essential to classify cultivated linseed varieties and make them useful. This can be accomplished by identifying new sources of genes for linseed improvement (Fu, 2005). Further, knowledge of the genetic diversity found in species helps in identifying different groups of germplasm (Tadesse *et al.* 2009). The importance of linseed cultivation has increased in the country due to huge decline in its production, mainly due to low yield and susceptibility to diseases. Linseed is an ancient oilseed crop in India and remains untouched crop in terms of genetic understanding and improvement. Therefore, an efficient breeding strategy is essential to develop promising genotypes, which is based on the information obtained from studies of crop diversity. The present study reveals the genetic diversity in linseed

through categorisation and frequency distribution within germplasm lines which can be helpful to improve in genetical characteristics of linseed.

MATERIALS AND METHODS

The present investigation was made to understand the genetical and morphological variation present in the linseed germplasm. The experimental materials were laid down in the field of Main Experimental Station, N.D. Uni. Of Agri. And Tech., Kanpur in rabi season. A total of 440 linseed germplasm was sown in Augmented Bloch Design with three checks repeated after every 40 lines. Three checks Neelam, T397 and Kiran were distributed systematically in each block. For the data record, eleven characters were recorded such as days to 50 % flowering (DF), days to maturity -(DM), PDI (AB) on leaves, plant height (cm)-(PH), number of primary branches per plant (NPB/P), number of secondary branches per plant (NSB/P), number of capsules per plant (NC/P), number of seeds per capsule (NS/P), seed yield per plant (g)- (SY/P) and 1000- seed weight (g)-(SW). The data for classification and frequency in per cent were analyses manually, while other genetic components were analysed statistically according to Federer (1956). The germplasm lines were screened to study the classification and frequency distribution of linseed.

RESULTS AND DISCUSSIONS

All the 11 characters of 440 germplasm entries were classified into various categories, with regard to petal colour of flower only two types of petal colour were observed i.e. blue and white. Out of 440 germplasm lines, 379 lines were having blue flower, while rest 61 lines

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were with white petals (Figure 1). The results of remaining 10 characters are present in Table 1 and 2, respectively. In the class interval (3.55 days) of 10 classes for days to 50% flower, class interval of 91.25-94.80 days had maximum number of germplasm (97) followed by 94.80-98.30 days (85), which was 22.05 and 19.32 per cent of entire population, respectively, while the class interval 84.15-87.70 and 73.50-77.05 days had represented the minimum number of germplasm 3 and 4 per cent, respectively of the entire population in each group.

In the class interval 2.4 days of 10 classes of days to maturity, the maximum number of germplasm (161) were in the range of 127.10-129.50 followed by 126 lines ranging 129.50-131.90 which accounted for 36.59 and 28.64 per cent of the entire germplasm, respectively, while only two germplasm line representing of entire population were recorded in each group of the class interval 117.50-119.90, 119.91-122.30 and 129.10-141.50, respectively. In the class interval 6.77 days of the 10 classes for the PDI (AB) on leaves, the class interval has maximum number of germplasm (83) ranged from 61.03-67.80 followed by 54.25-61.03 (65) which was 18.86 and 14.77 per cent frequencies, respectively, while the class interval of 20.38-27.15 had minimum number of germplasm (2) with the frequency of 0.45 per cent. In an interval of 5.97 cm of 10 classes for plant height, the maximum number of germplasm was in the class interval of 51.86-57.83 (108) followed by 57.83-63.80 (94), which was 24.55 and 21.36 per cent of entire population, respectively, while the minimum number of germplasm 2

in class interval of 87.68-93.64 followed by 4 in class interval of 33.95-39.97 was observed, respectively, with frequency of 0.45 and .091 per cent of entire population, respectively.

In the class interval of 2.09 primary branches of 5 classes for number of primary branches per plant, the maximum 273 followed by 139 germplasm lines were in class interval of 1.55-3.64 and 3.64-5.73, respectively, representing 62.05 and 31.59 per cent of entire population, respectively, while 2 germplasm lines (0.68 per cent) were observed in the class interval of 7.83-9.92 and 9.92-12.01, respectively. Of the number of secondary branches per plant categorised into 10 classes with an interval of 3.14 primary branches, the maximum 162 germplasm lines were in the class interval of 5.65-8.79 followed by 162 in 2.51-5.65 with frequency of 36.82 and 28.18 percent, respectively of entire population, while only 1 germplasm line (0.23 per cent) was observed in the class interval of 24.50-27.64 followed by 2 germplasm lines (0.45 per cent) in three class intervals vis. 21.36-24.50, 27.64-30.78 and 30.78-33.93. The number of capsules per plant is categorised into 10 classes with an interval of 13.8 capsules, the maximum number of germplasm lines (221) were in the class interval of 10.30-24.13 followed by 120 lines in the class interval of 24.13-37.96, which has frequency of 50.23 and 27.27 per cent, respectively, none of the lines were found in the range 93.28-107.11 and 120.94-134.77 and only 1 line was in the range of 107.11-120.94 accounting about 0.23 per cent of the entire population.

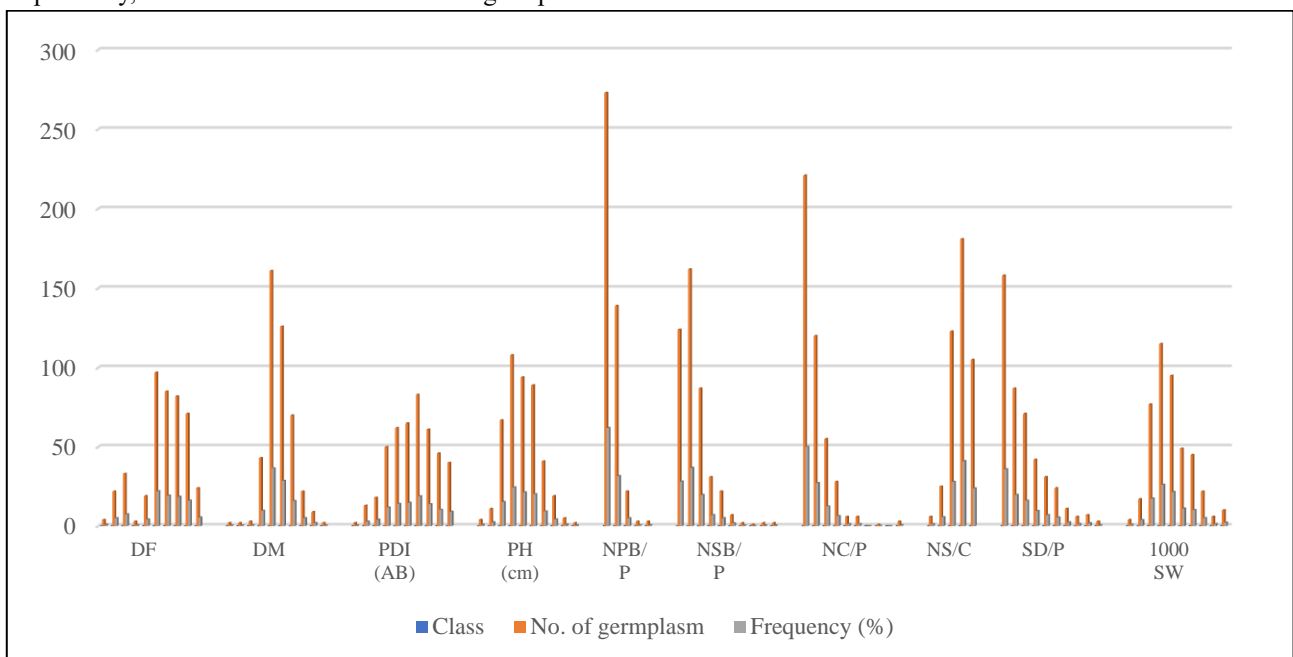


Figure 1: comparison within classification, number of germplasm and frequency (%) in 440 linseed germplasm

Table 1: Frequency distribution for DF, DM, PDI (AB), PH and NPB/P in 440 linseed germplasm

Days to 50% flowering			Days to maturity			PDI (AB) on leaves			Plant height (cm)			No. of primary branches per plant		
Class 1	No. of germ plasm	Frequency (%)	Class 2	No. of germ plasm	Frequency (%)	Class 3	No. of germ plasm	Frequency (%)	Class 4	No. of germ plasm	Frequency (%)	Class 5	No. of germ plasm	Frequency (%)
73.5-77.05	4	0.91	117.50-119.90	2	0.45	20.38-27.15	2	0.45	33.95-39.97	4	0.91	1.55-3.64	273	62.05
77.05-80.60	22	5.00	119.90-122.30	2	0.45	27.15-33.93	13	2.95	39.97-45.89	11	2.50	3.64-5.73	139	31.59
80.60-84.15	33	7.50	122.30-124.70	3	0.68	33.93-40.70	18	4.09	45.89-51.86	67	15.23	5.73-7.83	22	5.00
84.15-87.70	3	0.68	124.70-127.10	43	9.77	40.70-47.48	50	11.82	51.86-57.83	108	24.55	7.83-9.92	3	0.68
87.70-91.25	19	4.32	127.10-129.50	161	36.59	47.48-54.25	62	14.09	57.83-63.80	94	21.36	9.92-12.01	3	0.68
91.25-94.80	97	22.05	129.50-131.90	126	28.64	54.25-61.03	65	14.77	63.80-69.77	89	20.23			
94.80-98.35	85	19.32	131.90-134.30	70	15.91	61.03-67.80	83	18.86	69.77-75.74	41	9.32			
98.35-101.90	82	18.64	134.30-136.70	22	5.00	67.80-74.58	61	13.86	75.74-81.71	19	4.32			
101.90-105.45	71	16.14	136.70-129.10	9	2.05	74.58-81.35	46	10.45	81.71-87.68	5	1.14			
105.45-109.00	24	5.46	129.10-141.50	2	0.45	81.35-88.13	40	9.09	87.68-93.65	2	0.45			

Table 2: Frequency distribution for NSB/P, NC/P, NS/P, SY/P and 1000 SW in 440 linseed germplasm

No. of secondary branches per plant			No. of capsules per plant			No. of seeds per plant			Seed yield per plant (g)			1000-Seed weight (g)		
Class 6	No. of germ plasm	Frequency (%)	Class 7	No. of germ plasm	Frequency (%)	Class 8	No. of germ plasm	Frequency (%)	Class 9	No. of germ plasm	Frequency (%)	Class 10	No. of germ plasm	Frequency (%)
2.51-5.65	124	28.18	10.30-24.13	221	50.23	4.20-5.26	6	1.36	2.05-3.36	158	35.90	3.76-4.33	4	0.91
5.65-8.79	162	36.82	24.13-37.96	120	27.27	5.26-6.32	25	5.68	3.36-4.66	87	19.77	4.33-45.89	17	3.86
8.79-11.94	87	19.77	37.96-51.79	55	12.50	6.32-7.38	123	27.95	4.66-5.97	71	16.14	45.89-4.89	77	17.50
11.94-15.08	31	7.05	51.79-65.62	28	6.36	7.38-8.44	181	41.14	5.97-7.27	42	9.55	4.89-5.46	115	26.14
15.08-18.22	22	5.00	65.62-79.45	6	1.36	8.44-9.50	105	23.86	7.27-8.58	31	7.05	5.46-6.03	95	21.59
18.22-21.36	7	1.91	79.45-93.28	6	1.36				8.58-9.89	24	5.45	6.0-6.60	49	11.14
21.36-24.50	2	0.45	93.28-107.11	0	0.00				9.89-11.19	11	2.50	6.60-7.17	45	10.23
24.50-27.64	1	0.23	107.11-120.94	1	0.23				11.19-12.50	6	1.36	7.17-7.74	22	5.00
27.64-30.78	2	0.45	120.94-134.77	0	0.00				12.50-13.80	7	1.91	7.74-8.31	6	1.36
30.78-33.93	2	0.45	134.77-148.60	3	0.68				13.80-15.11	3	0.68	8.31-8.87	10	2.27

In the class interval 2.4 days of 10 classes of days to maturity, the maximum number of germplasm (161) were in the range of 127.10-129.50 followed by 126 lines ranging 129.50-131.90 which accounted for 36.59 and 28.64 per cent of the entire germplasm, respectively, while only two germplasm line representing of entire population were recorded in each group of the class interval 117.50-119.90, 119.91-122.30 and 129.10-141.50, respectively. In the class interval 6.77 days of the 10 classes for the PDI (AB) on leaves, the class interval has maximum number of germplasm (83) ranged from 61.03-67.80 followed by 54.25-61.03 (65) which was 18.86 and 14.77 per cent frequencies, respectively, while the class interval of 20.38-27.15 had minimum number of germplasm (2) with the frequency of 0.45 per cent. In an interval of 5.97 cm of 10 classes for plant height, the maximum number of germplasm was in the class interval of 51.86-57.83 (108) followed by 57.83-63.80 (94), which was 24.55 and 21.36 per cent of entire population, respectively, while the minimum number of germplasm 2 in class interval of 87.68-93.64 followed by 4 in class interval of 33.95-39.97 was observed, respectively, with frequency of 0.45 and .091 per cent of entire population, respectively.

In the class interval of 2.09 primary branches of 5 classes for number of primary branches per plant, the maximum 273 followed by 139 germplasm lines were in class interval of 1.55-3.64 and 3.64-5.73, respectively, representing 62.05 and 31.59 per cent of entire population, respectively, while 2 germplasm lines (0.68 per cent) were observed in the class interval of 7.83-9.92 and 9.92-12.01, respectively. Of the number of secondary branches per plant categorised into 10 classes with an interval of 3.14 primary branches, the maximum 162 germplasm lines were in the class interval of 5.65-8.79 followed by 162 in 2.51-5.65 with frequency of 36.82 and 28.18 percent, respectively of entire population, while only 1 germplasm line (0.23 per cent) was observed in the class interval of 24.50-27.64 followed by 2 germplasm lines (0.45 per cent) in three class intervals vis. 21.36-24.50, 27.64-30.78 and 30.78-33.93. The number of capsules per plant is categorised into 10 classes with an interval of 13.8 capsules, the maximum number of germplasm lines (221) were in the class interval of 10.30-24.13 followed by 120 lines in the class interval of 24.13-37.96, which has frequency of 50.23 and 27.27 per cent, respectively, none of the lines were found in the range 93.28-107.11 and 120.94-134.77 and only 1 line was in the range of 107.11-120.94 accounting about 0.23 per cent of the entire population.

In the class interval of 1.06 seeds of 5 classes for number of seeds per plant, the maximum 181 followed by 123 and 105 germplasm lines were in class interval of

1.55-3.64, 3.64-5.73 and 8.44-9.50, respectively, while the minimum 6 germplasm lines were found in class interval of 4.20-5.26 followed by 25 lines in 5.26-6.32, respectively, the frequency of 1.36 and 5.68 per cent, respectively of the entire population. The classification of yield per plant were grouped into 10 classes with 1.31 g, the maximum number of germplasm lines (158) were in the range of 2.05-3.36 followed by 87 lines in 3.36-4.66, respectively with frequencies of 35.90 and 19.77 per cent, respectively of entire population, while minimum 3 lines were in the range of 13.80 followed by 6 lines in 11.19-12.50 g which had 0.68 and 1.36 per cent frequency of entire population, respectively. . In the class interval (0.57g) of 10 classes for 1000-seed weight, class interval of 4.89-5.46 g had maximum number of germplasm (115) followed by 5.46-6.03 g (95), which was 26.14 and 21.59 per cent of entire population, respectively, , while the minimum 4 germplasm lines were found in class interval of 3.76-4.33 g followed by 6 lines in 7.74-8.30 g, respectively, the frequency of 0.91 and 1.36 per cent, respectively of the entire population. Overall, in this study of 440 germplasm lines for classification and characterization have largest variability in the entire population and it is useful to breeders for selection of superior parental lines which is use to improve linseed crops through breeding methodology.

CONCLUSION

This study highlights the classification and frequency distribution for various characters of four hundred forty germplasm lines linseed. The maximum germplasm diversity observed in the days to 50% flowering, plant height, number of primary branched per plant, number of secondary branched per plant, number of capsules per plant, number of seeds per plant and seed yield per plant. Most of the germplasm lines exhibits large labelled of variation in individual character of the entire population, since developing new varieties/hybrids requires diversity within the population for individual trait which was evident in studies conducted on classification and frequency distribution. Therefore, targeted breeding strategies and molecular approach are needed to enhance high yielding potential in new varieties.

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