Research Article
THE INTERNATIONAL JOURNAL OF BIOLOGICAL RESEARCH (TIJOBR) ISSN Online: 2618-1444
Vol. 4(1), 01-06, 2021
http://www.rndjournals.com

Breeding Potential of Rapeseed (*Brassica napus* L.) for Seed Oil and Quality Traits.

Rimsha Ishaq[1*], Zainab Shahbaz[2], Imrana Kousar[3], Ali Imran[2*], Muhammad Aftab[4]
[1]Institute of Molecular Biology & Biotechnology, Bahauddin Zakariya university, Multan, Pakistan.
[4]Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad, Pakistan.
[3]Government College Women University Faisalabad, Pakistan
[4]Formen Christian College, Lahore, Pakistan
*Corresponding author: rimshahbutt04@gmail.com; aliimranuaf10@outlook.com

Abstract

Edible oil is the basic constituent of human diet. Pakistan is spending huge foreign exchange for importing edible oil. So, there is dire need to focus on the research of oil seed crops to improve the production of oil. Present experiment was conducted in this context on seven *Brassica napus* L. accessions. Present study was, therefore, conducted to determine genetic basis of variation and hybrid vigor for various oil and quality attributing traits in order to identify promising parents which can be further used for the improvement of B. *napus*. For this purpose, following genotypes; Long silique, Legend, ZM-5, ZMR-4, ZM-17, Dunkeled and cyclon crossed in all possible combination by using full Diallel fashion through careful pollinations. Among parents and crosses, maximum mean value for oil contents and oleic acid was given by ZM-17 and Dunkeled × ZM-17 respectively. Among parents and crosses, maximum mean value for linolenic acid contents is given by Legend and ZM-17 × Dunkeled. For protein contents the Zm-5 and ZM-5 × ZM-17 performed superior from rest of all genotypes.

Key words: Genetic diveristy, Brassica napus L., yield

Introduction

Pakistan is considered an agricultural country and mainly depends upon agriculture. Contribution of Agriculture towards the progress of Pakistan if of prime importance. The agriculture share in the GDP of Pakistan is 19.8 % which indicates importance of this sector in country. Almost 42.3% people of Pakistan are availing jobs from agriculture sector and it is also a major source of raw material which is used by industries. During 1947-65production of edible oil in our country was self -sufficient. Now edible oil production declined and almost 68% imported from other countries to meet the current demand because locally produced oil is not enough. Major problem is the deficiency of high quality improved cultivars in the country. *Brassic napus* L. is grown Worldwide and is important source for edibles oil(Azizinia, 2011).

Environmental and genetic factors has adverse effect on oil quality in *Brassica* species. Mostly oil and protein both are used in culinary and animal feeds (Bhardwaj and Hamam, 2000). An import of oils begins in 1960 in Pakistan. During period of 1980 0.33 m tons of oil imported and figure was raised to 1.3 m tons in 1995. Rapseed and Mustard are grown on area of 0.477 m acres in Pakistan with the production of 0.182 m tones. Annually both Rapseed and Mustard gives 0.057 m tons of oils. Because of this scarcity, Pakistan imported 1.738 million tons of oil at the cost $ 2.663 billion in 2014–2015. The production of rapeseed oil during this period was 0.067 million tons that is 12% of the total production. (GOP, 2015–2016) locally cultivates varieties of *brassica* gives about 0.463 m tons of edible oil during year 2015-16. While the contribution of cotton towards oil market is higher than any other oilseed crops which are grown locally is 71% and sunflower got second position with contribution of 16%. During the year 2015-16 in Pakistan 538 thousand acres occupied by rapeseed and mustard with the production of 64 thousand tons edible oil. Pakistan has fertile land, good climate and almost all types of crops are grown in our country. Main crops which are grown in our country are wheat, rice, cotton and sugarcane and mostly research is being carried out by research stations mainly on these major crops. As far as oilseed crops are concerned these are almost negligible due to which production of oil is very low in country. Canola and sunflower are main crops which are

growing for oil purpose. Cotton has also major contribution in oilseed so major work should be done on cotton for its oil productivity.

These crops also play important role in health of human beings. There is necessity of breeding and advance biotechnology tools to increase the potential of crops to fulfill the current demand in country. Edibles oils are imported in in Pakistan from abroad due to shortage of improved cultivars, poor oil extraction methods, lack of awareness, shortage of high yielding cultivars, undefined policy, and ignorance of oilseed crops, unavailability of marketing system and competition with other major crops. Pakistan is unable to fulfill the demand of edible oil because there is less availability of certified seed of rapeseed, improved varieties of rapeseed, growing of oilseed crops on marginal lands, less adaptability of hybrids to environmental conditions, lack of perfect marketing system, lack of lodging and shattering resistant cultivars. To attain maximum yield in *Brassica* species there is need to develop cultivars having short duration through breeding with other genetically diverse species. The research estimates the following by Diallal analysis; High yielding hybrids, Hybrid vigor in *Brassica napus* L.

Materials and methods

Seven lines of *Brassica napus* were used for research purpose to develop high yielding cultivars. Those lines were Long silique, Legend, ZM-5, ZMR-4, ZM-17, Dunkeled and cyclon obtained from the Department of Plant Breeding Genetics, UAF, Pakistan. These lines were grown in the field area during the period of 2017 and crossed in all possible combination by using full Diallel fashion through careful pollinations. The seed was collected and then prepared for next sowing. Seeds of 49 crosses were sown in the field according to randomized complete block design within three replications by dibbler during October 2017. Distance between plants was 23 cm apart while the rows were maintained 45 cm apart. All agronomic practices were carried out properly which are recommended for *Brassica napus* L, throughout the cropping season. Seeds collected from crosses were sown during October 2017-2018 according to Randomized complete block design within three replications to record data for following traits, seed oil, oleic acid %, linolenic acid, and proteins contents %.

Statistical Analysis

The data of three repetitions for the hybrids and their parents for all attributes was subjected to statistical analysis given by Steel *et al*., (1997). After that data was investigated for heterosis were checked out.

Table 1- List of *Brassica napus* genotypes used in the research

Sr. No.	**CROSSES**
1	L.siliqua x Legend
2	L.siliqua x ZM-5
3	L.siliqua x ZMR-4
4	L.siliqua x ZM-17
5	L.siliqua x Dunkeled
6	L.siliqua x Cyclon
7	Legend x L.siliqua
8	Legend x ZM-5
9	Legend x ZMR-4
10	Legend x ZM-17
11	Legend x Dunkeled
12	Legend x Cyclon
13	ZM-5x L.siliqua
14	ZM-5 x Legend
15	ZM-5 x ZMR-4
16	ZM-5x ZM-17
17	ZM-5 x Dunkeled

18	ZM-5 x Cyclon
19	ZMR-4x L.siliqua
20	ZMR-4x Legend
21	ZMR-4x ZM-5
22	ZMR-4x ZM-17
23	ZMR-4x Dunkeled
24	ZMR-4x Cyclon
25	ZM-17 x L.siliqua
26	ZM-17 x Legend
27	ZM-17 x ZM-5
28	Zm-17 x ZMR-4
29	ZM-17 x Dunkeled
30	ZM-17 x Cyclon
31	Dunkeled × L.siliqua
32	Dunkeled × Legend
33	Dunkeled × ZM-5
34	Dunkeled × ZMR-4
35	Dunkeled × ZM-17
36	Dunkeled × Cyclon
37	Cyclon × L.siliqua
38	Cyclon × Legend
39	Cyclon × ZM-5
40	Cyclon × ZMR-4
41	Cyclon × ZM-17
42	Cyclon × Dunkeled

Results and discussion

Oil contents (%)

Maximum mean value for oil contents is 43.8% and minimum value for this trait is 34.2% (Fig 4.2.9). Among parents maximum mean value for oil contents was given by ZM-17 (41.9%) and is significantly different from all other parents while minimum value was given by cyclon (34.2 %). Among crosses maximum value for oil contents was given by Dunkeled × ZM-17 (43.8 %) so this cross is useful for the development of new cultivar with high percentage of oil in *brassica napus.* Abideen *et al*, (2013), Ali *et al.,* (2016) and Kumar *et al.,* (2018) discussed the same results.

Oleic acid (%)

Maximum mean value for oleic acid contents is 43.8% and minimum value for this trait is 34.2% (Fig 4.2.10). Among parents maximum mean value for oil contents was given by ZM-17 (41.9%) and is significantly different from all other parents while minimum value was given by cyclon (34.2 %). Among crosses maximum value for oil contents was given by Dunkeled × ZM-17 (43.8 %) so this cross is useful for the development of new cultivar with high percentage of oil in *brassica napus.* The findings are similar with the results of Nasim and Farhatullah (2013), Shehzad *et al.,* (2015) and Ali *et al.,* (2016), Kumar *et al.,* (2018).

Linolenic acid (%)

Maximum mean value for linolenic acid contents is 14.4 % and minimum value for this trait is 7.4 % (Fig 4.2.11). Among parents maximum mean value for oil contents was given by Legend (14.4%) and is significantly different from all other parents while minimum value was given by cyclon

(8.6 %). Among crosses maximum value for linolenic acid contents was given by ZM-17 × Dunkeled (14.0 %) so this cross is useful for the development of new cultivar with high percentage of linolenic acid in *brassica napus.* Same results were reported by Chaudhari *et al.*, (2015), Ali e*t al*., (2016), and Ishaq *et al*., (2017).

Protein contents (%)

Maximum mean value for protein contents is 30.5 % and minimum value for this trait is 19.7% (Fig 4.2.12). Among parents maximum mean value for protein contents was given by Zm-5 (29.0%) and is significantly different from all other parents while minimum value was given by Dunkeled (22.5 %). Among crosses maximum value for linolenic acid contents was given by ZM-5 × ZM-17 (14.0 %) so this cross is useful for the development of new cultivar with high percentage of linolenic acid in *brassica napus.* Marjanovic- Jeromela *et al*., (2011) also discussed the same result for this trait.

Conclusions

According to the result the analyses of variance for data revealed significant differences among different genotypes for seed oil, oleic acid %, linolenic acid, proteins contents %, and linoleic acid. The genotypes evaluated in this study exhibited an important level of diversity for seed oil, oleic acid %, linolenic acid, proteins contents %, and linoleic acid. From the present study the high yielding cross combinations can be utilized in future breeding programs for developing high yielding genotypes.

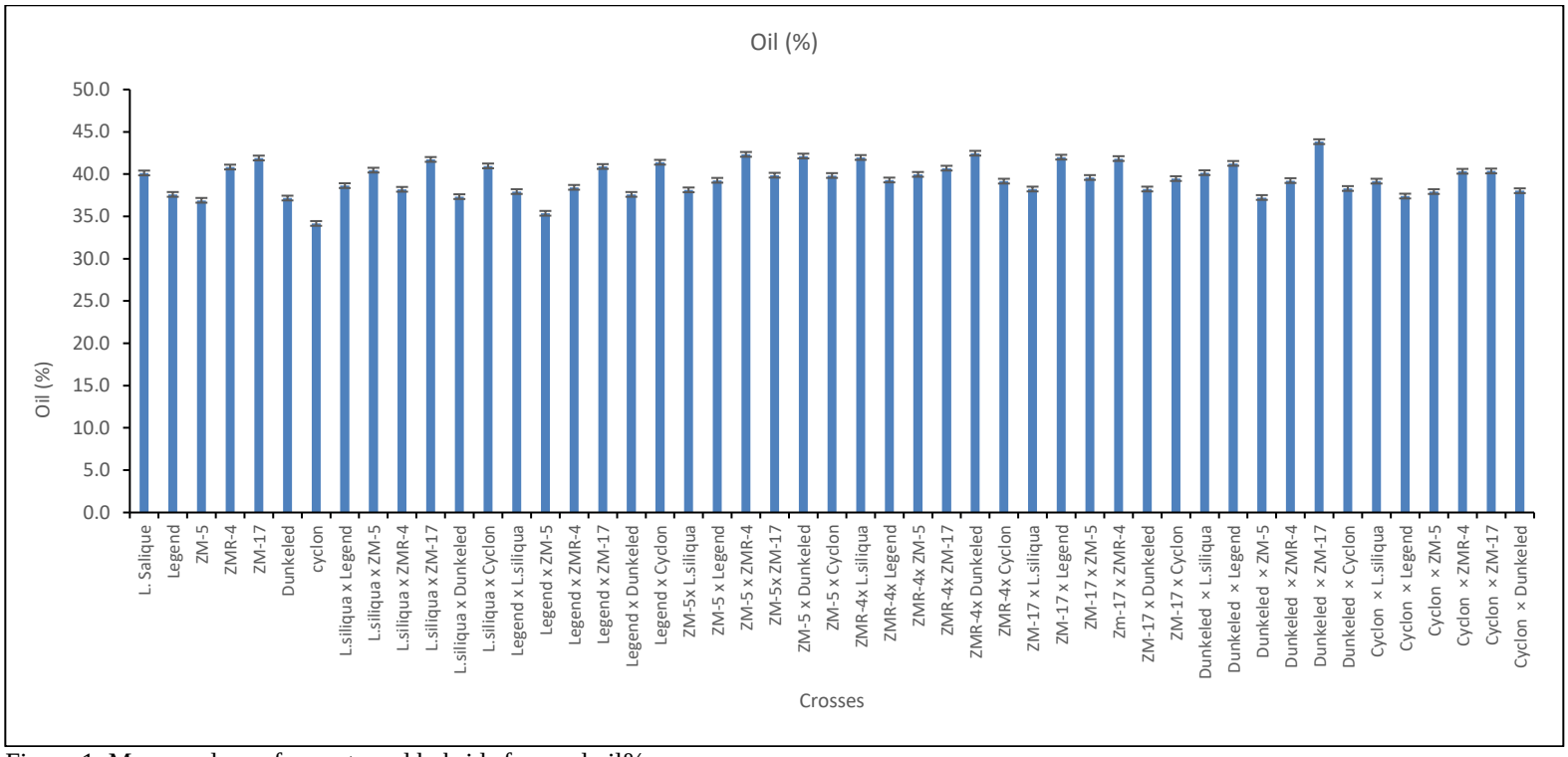

Figure 1. Means values of parents and hybrids for seed oil%

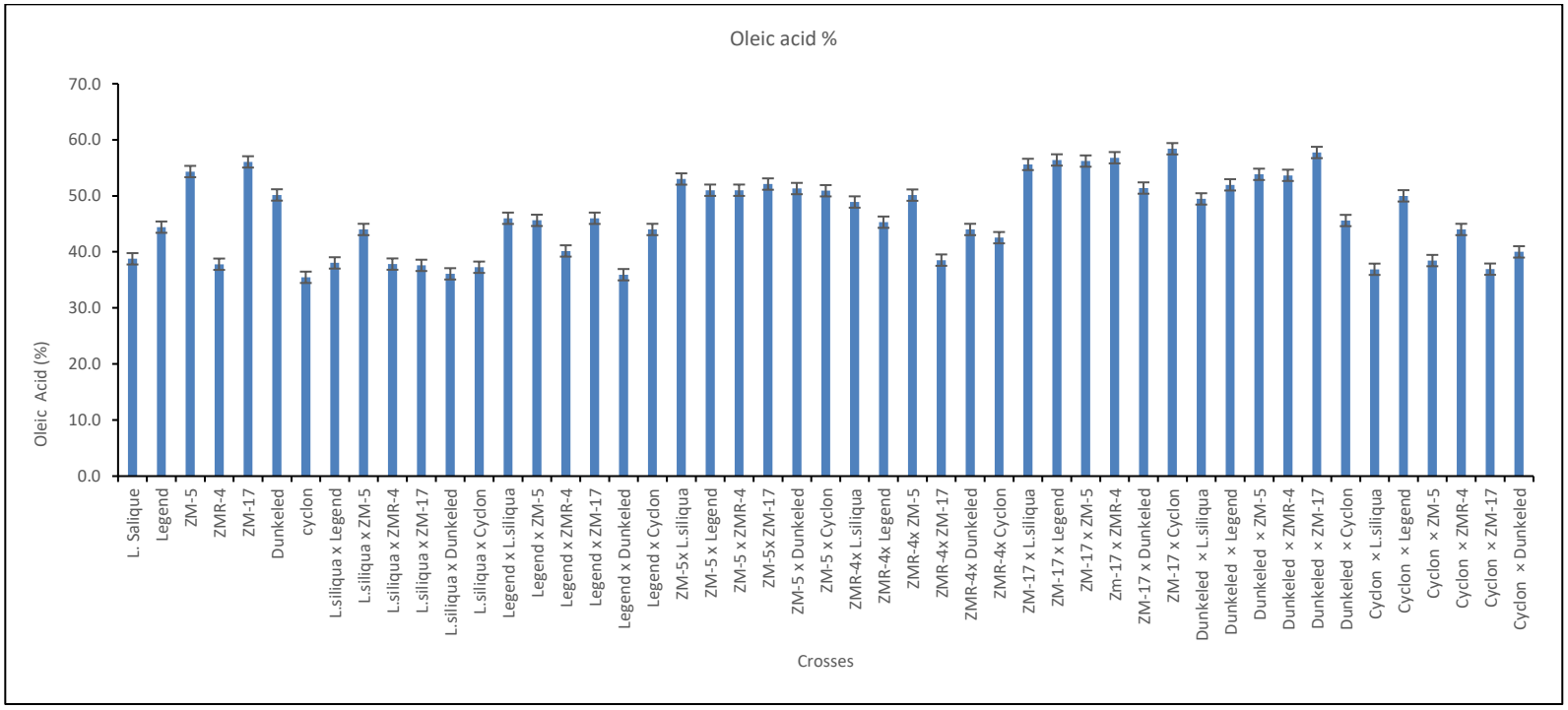

Figure 2. Means values of parents and hybrids for oleic acid %.

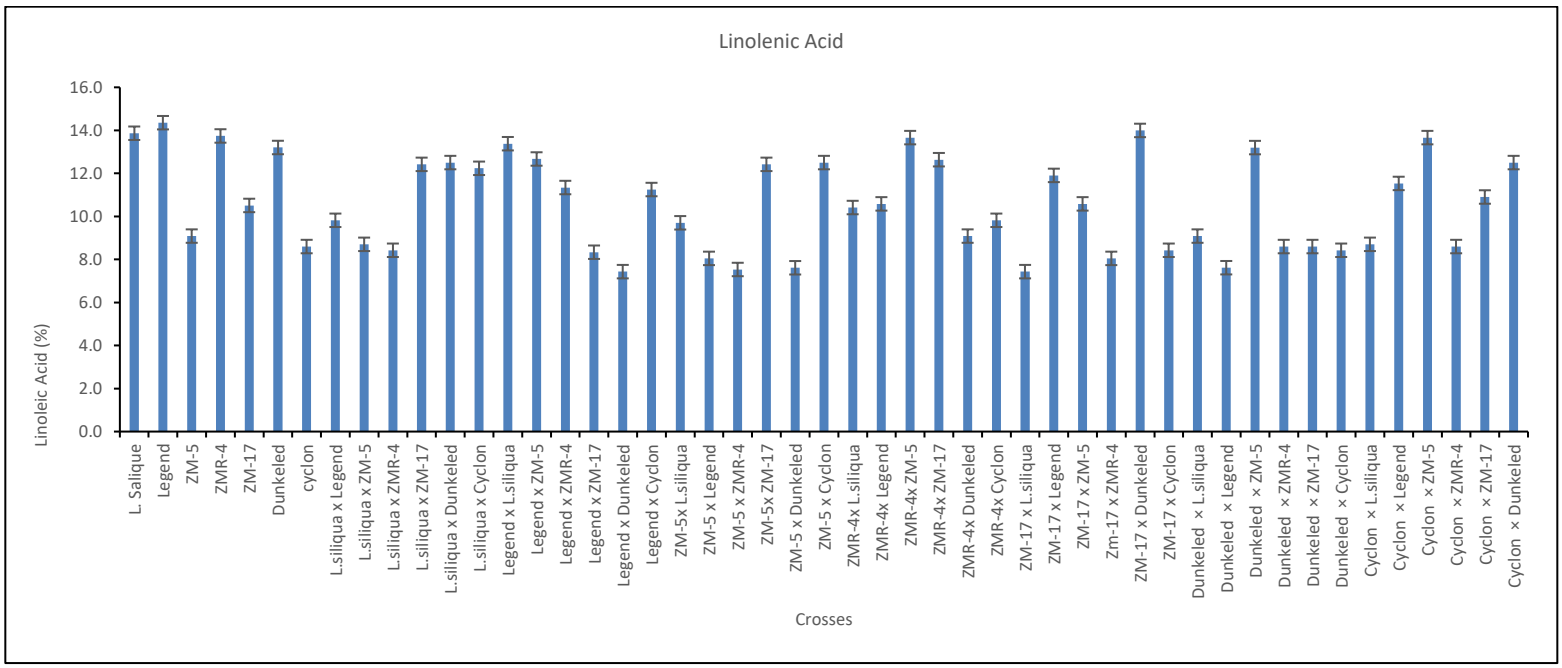

Figure 3. Means values of parents and hybrids for linolenic acid%

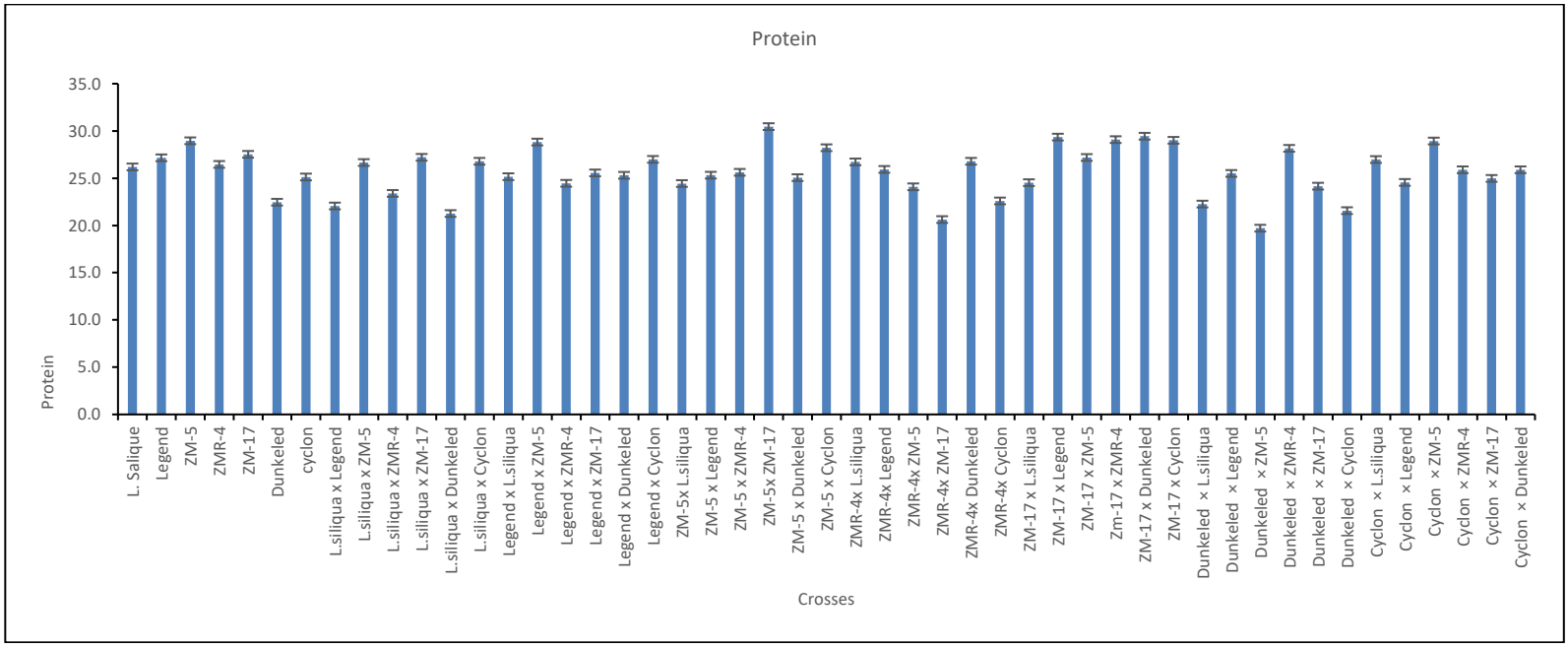

Figure 4. Means values of parents and hybrids for protein contents%

References

Abideen, S. N. U., F. Nadeem and S. A. Abideen. 2013. Genetic Variability and Correlation Studies in *Brassica napus* L. Genotypes. Int. J. Innov. Appl., 2: 574–581.

Ali, M., Raziuddin, I. H. Khalil1, I.A. Khalil1, Anwar-ul-Haq, R. Khan, Ghulamullah, Monsif Ur Rehman and S. khan. 2016. Genetics of seed quality attributes in *Brassica napus* L. pure. appl. Biol., 5: 1230-1244.

Azizinia S. 2012. Combining ability analysis of yield component parameters in winter rapeseed genotypes (*Brassica napus* L.) J. Agric. Sci., 4: 87-94.

Bhardwaj, H.L. and A.A. Hamama. 2000. Oil, erucic acid, and glucosinolate contents in winter hardy rapeseed germplasms. Ind. J. Crops Prod., 12: 33-38.

Chaudhari, N.H., R. N. Patel, R. A. Gami1 and S. K. Shah. 2015. Study of combining ability and heterosis for seed yield and seed quality traits in rapeseed. The bioscan., 10: 1985-1989.

GOP. 2015–2016. Ministry of Finance, Economic Advisor' Wing, Islamabad.

Ishaq, M., R. Razia and S. A. Khan. 2016. Exploring genotypic variations for improved oil content and healthy fatty acids composition in rapeseed (*Brassica napus L.*) J. Sci. Food. Agric., 97: 1924–193.

Kumar, B., A. Pandey and A. Kumari. 2018. Heterosis and combining ability of F_1 and F_2 generations of Indian mustard for seed yield and its attributes. J. Oilseed Brassica., 9: 33-39.

Marjanovic-Jeromela, A., R. Marinkovic and D. Miladinovic. 2007. Combining abilities of rapeseed (*Brassica napus* L.) varieties. Genetika. 39: 53-62.

Nasim, A., Farhatullah, S. Iqbal, S. Shah and S.M. Azam, 2013. Genetic variability and correlation studies for morphophysiological traits in *Brassica napus L*. Pak. J. Bot., 45: 1229-1234.

Shehzad, A., H. A. Sadaqat, M. Ali, M. F. Ashraf. 2015. Combining Ability Analysis and Genetic-Effects Studies for Some Important Quality Characters in *Brassica napus* L. Turk. J. Agri. Food Sci. Technol., 3: 790-795.