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Genetic studies among diverse soybean (*Glycine max* L. Merrill) genotypes for variability and correlation at Swat

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Abstract

An experiment was conducted to evaluate variability and correlation among yield and yield related attributes in Soybean (*Glycine max* L). Ten accessions of soybean including two checks were used in this experiment. RCB designe was used with three replications. Data was recorded on eight traits including days to 50% flowering days maturity, plant height, number of pods plant^{-1}, pod length, 100 seed weigh, seed yield ha^{-1} and oil contents (OC%). The analysis of variance revealed highly significant variation among the accessions for all the studied traits. Correlation analysis exhibited positive and significant correlation between seed yield days to 50% flowering, days to maturity, pods plant^{-1}, 100 seed weight. Positive correlation was observed for seed yield with pod length. It showed negative correlation with plant height. Among the tested genotypes Elgin was high yielding with 3 tons ha^{-1} and LD-3309 was low yielding with 2.4 tons ha^{-1} dry seed production. In terms of maturity LD-3309 was early while Elgin was late maturing type. The present study suggests that these genotypes may be further studied and included in breeding programs.

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Introduction

Soybean (*Glycine max* L. Merrill) is one among the oldest crops of the world and is considered more an oilseed crop than a pulse. Cultivated soybean, *Glycine max* (L.) Merr., is a tetraploid (2n=40), belong to the family Leguminosae, the subfamily Papilionoideae, the tribe Phaseoleae, the genus Glycine Willd. and the subgenus Soja (Moench). Nutritionally, it contain about 37 to 42% high quality protein, 6% ash, 29% carbohydrate and 17-24% oil. The oil portion is composed of about 85% poly-unsaturated fatty acids (PFA) (Balasubramaniyan and Palaniappan, 2003; Iqbal *et al* 2003; Malik *et al.,* 2006). In Pakistan, soybean is one of the non-conventional oilseed crops (Malik *et al.,* 2006) and is cultivated under a wide range of agro-ecological zones. During 2006, national average yield of soybean was 1250 kg/ha is very low compared with its potential yields obtained in other soybean producing countries (Govt. of Pakistan, 2006). During 2010-11 in Pakistan, soybean was cultivated on area of 129 hectares which produced 89 tons of seed, with 573 kg ha-1. The cultivation of soybean drastically reduced last ten years (Govt. of Pakistan 2010-11).

The judgment of genetic diversity in germplasm collection can make possible the classification and identification of diverse genotypes with possible utility in a breeding course. Also, a reasonable way to launch any breeding program for crop improvement is; to review the variation present in the germplasm (Tyagi and Sethi 2011). Breeding to improve yield of crops, the breeder the option to select yield directly or indirectly through yield related traits. The correlations of yield with yield components and morphological traits has been studied extensively and used as a tool to improve seed yield of soybean (Arshad *et al.,* 2006). In this backdrop, therefore, the proposed study is aimed with the objectives; to study the variability and correlation among yield and morphological attributes and to identify the best performing genotypes in term of yield and maturity.

Materials and methods

Site and field plot techniques

The present study

is conducted at Agriculture Research Institute (North) Mingora Swat during in Kharif 2013. Ten (10) different soybean accessions including two checks (Malakand-96 and Swat-84) of diverse genetic background were evaluated. Experimental plot was thoroughly prepared and was laid out in RCB design with three replications. Plot size consisted of four rows each was five meter long and forty-five centimeter apart (5x0.45x4). Standard agronomic practices were carried out for successful crop production.

Observations recording

Data was recorded on the following parameters after germination; days to 50% flowering (DFF), days maturity (DM), plant height (PH), number of pods plant^{-1} (NPP^{-1}), pod length (PL), 100 seed weigh (HSW), seed yield ha^{-1} (SYHa^{-1}), and oil contents (OC%).

Data analysis

Averages were calculated for recorded data in each replication. Data analysis was carried out using MSTATC statistical package and ANOVA, LSD and Correlation according to Steel and Torrei (1980).

Results and discussion

Analysis of variance

Data on eight characters of *Glycene max* including days to 50% flowering, days to maturity, plant height, number of pods plant^{-1}, pod length, 100 seed weight, seed yield ha^{-1}, and oil contents were collected. The analysis of variance for the 8 traits in the present study revealed highly significant variation among the accessions (Table 1). Among the tested genotypes; Days to 50% flowering ranged from 74.33 to 50.33 days, days to maturity (152.3 to 135.7), plant height (200.5 cm and 98.6 cm), number of pods plant^{-1} (208.2 to 92.47), pod length (4.373 and 3.681 cm), 100 seed weight (12.67 and 21.84 g), seed yield ha^{-1} (3.36 and 2.46 tons ha^{-1}) and oil contents% ranged from 19.33 to 16.34% (Table: 2). High variability observed might be attributed to their genetic makeup and the differences in the geographical regions from

which they have been originated. These results are in confirmation with the previous findings of Arshad *et al.,* (2014), Aondover *et al.,* (2013), Ghodrati (2013), Reni and Rao,. (2013), Machikowa and Laosuwan., (2011), Malik *et al.,* (2011), Iqbal *et al.,* (2010), Ramteke *et al.,* (2010), Karasu *et al.,* (2009), Malik *et al.,* (2007) who reported significant differences for yield and its components traits.

Table 1. Mean squares of the 10 genotypes of *Glycene max* L. for 8 traits (Kharif 2013).

	Df	DFF	DM	PH	NPP^{-1}	PL	HSW	SY Ha^{-1}	OC%
Replication	2	5.895	51.702	128.685	416.643	0.090	0.0965	5720.667	0.001
Varieties	18	166.113**	76.536**	2530.972**	4199.010**	0.133**	17.330**	752540.952**	3.144*
Error	36	16.043	9.165	80.604	436.544	0.038	0.868	42290.246	0.001
Total	56	3579.368	1810.982	48716.620	92131.061	3.959	345.113	15079627.327	56.572

**: Significant.

Table 2. Means of the 10 genotypes of *Glycene max* L. for eight traits (Kharif 2013).

S. No	Accessions	DFF	DM	PH	NPP^{-1}	PL	HSW	SY Ha^{-1}	OC%
1	249-3130	56.33	143.7	114.1	208.2	4.373	15.71	3863	16.98
2	Beeson	59.67	143.7	113.7	189.9	3.927	14.75	3885	16.51
3	Corsoy	65.67	142.7	121.1	204.1	3.681	15.03	2858	18.16
4	E-1360	59.00	144.0	103.9	93.13	3.947	14.30	3367	18.76
5	E-1469	63.00	145.3	98.60	138.7	3.807	17.57	2920	16.34
6	Elgin	74.33	152.3	137.0	164.5	3.917	21.84	3936	18.23
7	Kwangko	59.33	145.3	200.5	140.8	4.273	15.95	2990	16.97
8	LD-3309	50.33	135.7	129.4	152.7	4.347	12.67	2467	18.05
9	Malakand-96	66.33	143.3	104.4	92.47	4.173	15.72	3619	18.35
10	Swat-84	61.33	144.3	119.3	106.9	4.013	18.22	3433	19.33
LSD		6.33	5.013	14.87	34.60	0.3228	1.543	340.5	0.05237

Correlation analysis

In the present study positive and significant correlation was observed between seed yield days to 50% flowering, days to maturity, pods plant^{-1}, 100 seed weight. Positive correlation was observed for seed yield with pod length (Table 3).

Table 3. Correlation among nine yield and yield related attributes of *Glycene max* L.

	DFF	DM	PH	NPP^{-1}	PL	HSW	SY Ha^{-1}	OC%
DFF	1	0.709**	0.338*	-0.297*	-0.420**	0.251*	0.245*	0.063
DM		1	0.386*	-0.212	-0.379*	0.619**	0.444**	-0.064
PH			1	-0.213	-0.033	0.219	-0.126	-0.066
NPP^{-1}				1	-0.082	-0.348*	0.142**	-0.317*
PL					1	-0.129	0.038	-0.104
HSW						1	0.422**	-0.203
SY Ha^{-1}							1	-0.109
OC%								1

**= significant at 1% and *= significant at 5% level of probability.

The present results are in agreement with the results obtained by Arshad *et al.,* (2014) who reported positive significant correlation between the seed yield and days to flowering. Ali *et al.,* (2013) reported significant correlation between seed yield and pods plant^{-1}. Aondover *et al.,* (2013) also reported positive significant relation between seed yield and pods plant^{-1}. El-Mohsin *et al.,* (2013) also observed positive significant correlation of seed yield with pods plant^{-1} and 100 seed weight. Ghodrati *et al.,* (2013) revealed

that seed yield had significant correlations with 100 seed weight, number of pods plant^{-1} and days to maturity. Aditya *et al.,* (2011) reported positive significant correlation of seed yield with dry number of pods plant^{-1}. Bekele and Alemahu., (2011) showed that seed yield was strongly associated with pods plant^{-1} and days to maturity. Malik *et al.,* (2011) reported positive significant correlation for seed yield with pods plant-1 and 100-seed weight. The present results are contrasting with Ramteke *et al.,* (2010) who showed negative significant correlation for seed yield with days to flowering g and day to maturity. Seed yield revealed negative correlation with plant height.

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