БИОЛОГИЧЕСКИЕ НАУКИ

STATISTICAL BASIS FOR DETERMINATION OF GENOTYPE TO ENVIRONMENTAL ADAPTATION

Kuliev Tojiddin Xamdamovich*,
Sultonova Kumush Ruzimurod kizi**,
Bakeev Rifat Serverovich*,
Ismoilova Karomatkhon Maxmudjonovna*
**Gulistan state University,*
***Samarkand State Veterinary Medical Institute*
DOI: 10.31618/asj.2707-9864.2020.3.41.36

Abstract. This study is determined a level of correlation within nine traits, variation, coefficient of determination and similarity of martixes in hairy vetch (Vicia villosa Roth) under control and salinity condition. It was found that a potential index of traits in salinity decreased by 5-17% compared to non-saline soil. The weight of the bean, the number of seed per bean and its weight were strongly determined and varied. Also, a similarity of the correlation matrixes shows as 91.6%. Our results suggests, a hairy vetch is a tolerant to salinity.

Key words: Correlation, determination, variation, saline soil, martix of correlation, hairy vetch.

Introduction

The environment, especially the soil provides a usuful macro and micro elements for plant growth and development. Plant traits are formed based on its genetic potentials. Therefore, a quantitive traits can vary among genotypes. A strong variation of quantitative traits still remained as a actual issues in genetics and breeding. Although quantitative traits have been studied for more than 150 years, their genetics has not been fully studied yet [1].

Using a modern technologies and innovations in biological research, it has been determined that environmental factors influences a systemic alteration of organims. Therefore, it is recommended ecological, biological, eco-biological and genotypic trait-indicators [2].

The level of soil salinity is known to provide a stressful condition for the plant. In the saline soil, Na^+ cations and CI^- ions are toxic response. Under the influence of salts, the osmotic pressure of the soil solution increases, as a result, the root does not receive the required amount of water. Therefore, the plant productivity is significantly decreased [3,4].

Natural environmental conditions allow plants to adapt under salinity. It has been found that harvested cereals from dry climates are more tolerant to salinity than harvested from humidity conditions [5].

Along the salinity stress, there are other factors, such as an agronomic measures, including sowing rate and duration, amount of mineral fertilizers may also create a unfavorable conditions for plant growth and development. For instance, the level of variation of traits in sunflower plant were increased under stressfull condition than normal conditions. Also, it was noted that the degree of correlation between characters increased when winter wheat were planted a bit late and thick. In moderate salinity conditions, a bean weight and length of vetch is decreased by 25% and 4.8% respectively compared to weakly saline conditions [6,7].

The effect of steroids has been mainly studied as an increase of plant adaptation to soil salinity levels. In saline soil conditions, the coefficient of determination was 0.8-0.11 without steroid treatment, while it was -0.03-0.04 under the influence of compounds of steroids. This indicates that the compounds of a steroids can create suitable conditions for the growth and development of wheat under salinity [8].

In general, the extemal environment allows to survive of adaptive and specific genotypes. As an example, there are many halophytes and salt-tolerant plants that are common in the Mirzachul lands (highly saline area). Those plants may a crusial for breeding. However, there is no considerable criteria to determination of plant tolerance in terms of scientific methods so far. For this reason, the selection and creation of new genotypes as a stress tolerant remains one of the urgent tasks for current plant breeding. Our study provides some information to improve the methods for determining the tolerance of plants to salinity stress. The main purpose of the work is to study of statistical basis for determining the tolerance of hairy vetch to soil salinity levels.

Materials and methods

Plant Materials. The object of the experiment wasA hairy vetch (Vicia villosa Roth) plant was used in this study. As a non saline soil treatment, hairy vetch collected from Zaamin district of Jizzakh region. As a saline soil treatment, hairy vetch collected from Mirzaabad district of Syrdarya region.

Data analysis. After harvesting of yield from saline and non-saline soils condition, the quantitate parameters of beans were measured. The data was statistically analyzed using the SPSS-14 program. It is includeed the correlation (r), determination (r 2) and coefficients of variability (Cv,%) [9]. A similarity of the correlation matrix was determined according to N.S. Rostova method [2].

Results and discussion

Our results shows that the level of soil salinity was affected to the bean featuries. The weight of bean was 0.18 g in non-saline soil conditions and 0.14 g in saline soil conditions. The difference between them was 19.1%. Similar results were observed at length of bean. A length of bean was 2.72 sm in non-saline soils and 2.28 sm in saline soils, the difference was 16.06%.

Other featuries such as width of bean, number of seed in legume, weight of seeds, and weight of 100 seeds were 5-11% lower in saline soil conditions than control. Non-polinated bulbs was a higher percentage in saline than non saline condition, as 34.85% and a 16.99 % respectively. A grain yield (percentage of grain in legumes) was also higher than other featuries in saline soil conditions (Table-1).

Our biometrical analysis showed that the soil salinity levels affected to the variation of hairy vetch traits. This results stimulated to study the specific features of trait variations.The data is shown in Figure-1. The weight of bean (1), the number of seeds per bean (5) and weight of seeds (6) were found as a strongly determined and varied. Such result was also observed in saline and non-saline soil conditions. It means that these traits are strongly associated with other traits. Therefore, this traits clearly depend both genotype and the external environment, which allows to determine adaptability. These traits can be called an eco-biological indicators.

Table-1.

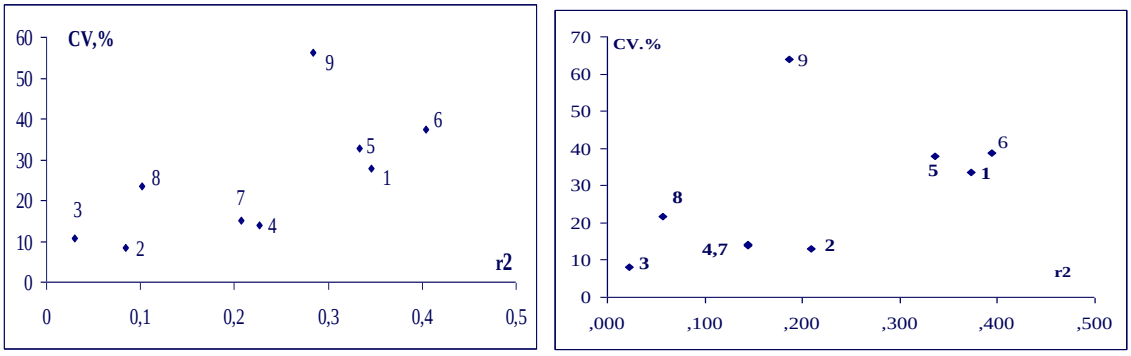
Effect of levels of salinity stress on potential characters of legum.

Statistic characters	Weight of bean (g)	Length of bean (mm)	Width of bean (mm)	Thickness of bean (mm)	Number of seeds per bean	Weight of seed per bean	Harvest index,%	Weight of 1000 seeds (g),	Non pollinated bolts,%
	Legum under control								
The arifmetic mean	0,18 ±0.01	2,72 ±0.03	0,71 ±0.01	0,52 ±0.01	3,20 ±0.15	0,12 ±0.01	63,57±1.35	3,71 ±0.12	34,85 ±2.76
Minimum	0,09	2,20	0,55	0,39	2,00	0,06	43,75	2,00	0,00
Maximum	0,34	3,30	0,90	0,65	6,00	0,24	87,50	6,33	60,00
r^2	0,34	0,08	0,03	0,22	0,33	0,40	0,21	0,10	0,28
Cv,%	27,7	8,37	10,7	14.0	32,8	37,4	15,1	23,4	56,2
	Legum under saline soil								
The arifmetic mean	0,14 ±0.01	2,28 ±0.04	0,67 ±0.01	0,49 ±0.01	2,98 ±0.16	0,10 ±0.01	69,62 ±1.39	3,53 ±0.11	28,93 ±2.61
Minimum	0,06	1,50	0,51	0,39	1,00	0,03	40,00	2,00	0,00
Maximum	0,25	3,10	0,80	0,65	6,00	0,19	87,50	5,50	66,67
r^2	0,37	0,21	0,02	0,15	0,34	0,39	0,14	0,06	0,19
Cv,%	33,6	13,1	8,2	13,9	38	38,8	14,1	21,7	63,9
Effect,%	-19.1	-16.06	-5.04	-5.86	-6.87	-11.43	+9.51	-4.89	-16.99

Note: here, r^2- determination, Cv,% coefficent of variation.

The length of bean (2), thickness of bean (4) weight of 100 seeds (7) were moderately determined and less variable. Although the variation of these traits are not independent, it can be called a biological indicators. Because, a multiple biological features are summed in genotype.

The width of bean (3) was less determined and less variable in both conditions (Table-1 and Figure-1). It means, this trait can variable independently and less variable to environmental responses. Therefore this trait is called a genotypic indicator.



control Salinity

Figure-1. Effect of salinity to variation of traits(Cv,%) and determination (r2). Numbers mean a traits: 1- weight of bean; 2- length of bean; 3- width of bean; 4- tickness of bean; 5- number of seed per bean; 6- weight of seed per bean; 7- weight of 100 seeds; 8- harvest index; 9- non-pollinated bolts.

The soil salinity is not only affected to the quantitative traits, meantime, it also influence to the degree of correlational relashinships. The average coefficient of determination was 0.08 and 0.21 in non-saline and saline soil conditions respectivily. It indicates that this trait is strongly influenced by soil salinity. The level of correlational relationships between quantitative traits also confirmed in Figure-2.

A strong correlation was observed between the weight of bean (1), the number of seeds per bean (5), and the weight of seeds per bean (6) in both conditions. The correlation coefficient between these characters was higher than r = 0.7. The correlation between weight of bean (1) and length of bean (2) and the number of seeds per bean (5) showed a weak determination (r = 0.3) in non-saline soil conditions. However, this trait was modarate value (r = 0.61) in saline soil conditions. Same results were observed between the number of seeds per bean (5) and the weight of 100 seeds (7). It is also found an inverse correlation between the number of non-pollinated bulbs (9) and the weight of bean (1), the length of bean (2), the thickness of bean (4), the number of seeds per bean (5), the weight of bean (6) weight of 100 seeds (7). It means, the weight of bean, a number of seeds and weight of seeds dropped when the number of unpollinated bulbs are higher. The number of unpollinated bulbs increased in saline soil conditions.

The figure-1 shows that the level of soil salinity affected to the level of correlational relationships between the plant traits. But it is difficult to determine how they are similar or different. In this case, it is recommended to use the method of comparison of correlation matrixes. The results indicated that the similarity of the correlation matrixes was 91.6%. If the similarity of the matrixes is higher than 90%, it is called a highly similar matrixes [2]. Hence, the very similarity of the correlation matrixes suggests that the soil salinity levels did not strongly influence to vika traits. This indicates that the hairy vetch is a salt tolerance plant. The hairy vetch was also noted as a tolerant by other researchers [10].

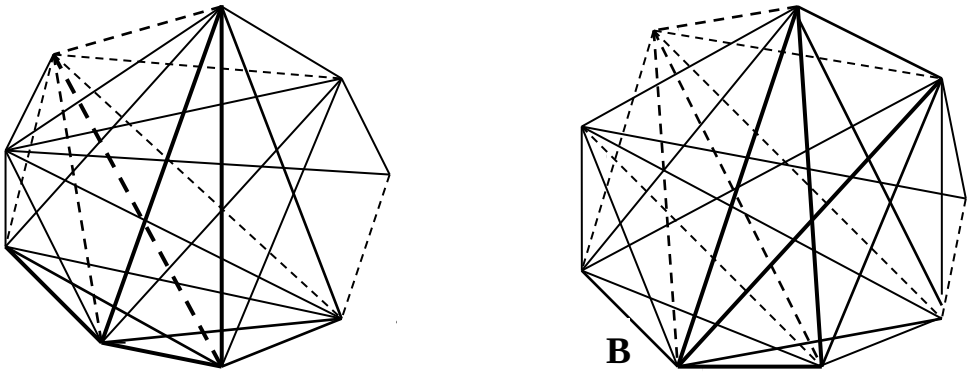


Figure-2. Level of corrilation.
A-control; B-salinity.
Note: Numbers mean a traits and lines mean a level of correlation between traits:

r=0.3-0.5; r=0.5-0.7; r=>0.7; r=-0.3-0.5; r= -0.5-0.7

Conclusion

1. Approximately a 5–17% of quantitive features shows a lower value in salinity condition than in control condition.

2. A quantitive traits including a bean weight, number of grains in the bean and a weight of gain were strongly determined in both conditions.

3. The similarity of the correlation matrix was a 91.6%. It means a hairy vica is a tolerant to salt.

4. The method of comparing a correlation matrix can be used to compare genotypes.

References

1. Brach N.B. Razvitiy metodov izucheniya nasledovaniya kolichestvennix priznakov // Trudi po prikl.bot., gen., i sel.SPb.:VIR,2011.T.167.S.23-35

2. Rostova N.S. Korrelyatsii: struktura i izmenchivost . SPb.: Izd-vo S.-Peterb.un-ta, 2002. T.94.S.-308.

3. Geissler N., Hussin S., Koyro H.-W. Interactive effects of NaCl salinity and elevated atmospheric CO_2 concentration on growth. photosynthesis. water relations and chemical composition of the potential cash crop halophyte Aster tripolium L. // Environ. Exp. Bot. 2009. V. 65. P. 220–231.

4. Munns R. Comparative physiology of salt and water stress // Plant Cell Environ. 2002. V. 25. P. 239–250.

5. Koyro H.-W.. Geissler N.. Hussin S. Survival at Extreme Locations: Life Strategies of Halophytes // Salinity and Water Stress / Eds. Ashraf M.. Ozturk M.. Athar H.R. Netherlands: Springer Netherlands. 2009. P. 167–177.

6. Kuliyev T. Vika (VICIA VILLOSA ROTH) biometrik korsatkichlariga tuproq shorlanish darajasining tasiri// Uzbekiston agrar fani xabornomasi. Toshkent 2016. №1(63).2016. 60-66.b.

7. Kuliev T. Izmenchivost i determinirovannost priznakov podsolnechnika v usloviiah pochvennogo zasoleniya // Naýchnyi vestnik. №1(3), 2015. Rossiia. 84-90 s.

8. Ismailova K. M. The impact of steroid nature compounds on the mutual connection level of overall indicators of winter wheat. European Science Review. Vienna. 2018. –P. 11-14.

9. Shishliannikova L.M. Matematicheskoe soprovojdenie naýchnoi raboty s pomoiý staticheskogo paketa SRSS for Windows 11.5.0 /Uchebno-metodicheskoe posobie M., 2005.S.105.

10.Trofimov I.T., Tolstov M.V., Bystrov A.V., Poriadin V.V. Vika mohnataia-tsennaia kormovaia kultura dlia kislyh i elochnyh pochv// Vestnik Altaiskogo gosudarstvennogo universiteta. 2010,-№ 8 (70).- S.-18-20.