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STYDY OF SOME GENETIC PARAMETERS IN FABA BEAN

ABSTRACT

The importance of assessing the genetic parameters comes in knowing how the genetic factors are transmitted from one generation to another, as well as their relationship to each other and their effect on determining the phenotypic of the plant. And this is through knowing the genetic behavior and the nature of the genetic action, which is of great importance in determining the appropriate method for breeding and improvement. Selection for a high yield in crops, including faba bean, requires knowledge of the nature and amount of variance in germplasm because genetic differences are desirable for plant breeders. The success of any breeding program must depend on the desired genetic variance present in the plant community, and had it not been for the occurrence of these variants, the plant species that surpassed their parents in productive and qualitative characteristics would not have been found. In view of the increasing demand for the crop of faba bean as an important food and medical source for humans, as well as the absence of breeding stations concerned with preserving the varieties cultivated in the country or developing new varieties with desirable production and quality specifications, for the purpose of advancing the current reality of producing this crop, researchers have devoted their efforts to exploit the means and genetic information they have available as tributaries of breeding and improving this crop, where many plant breeders were interested in the phenomenon of heterosis, and it was exploited in the development of many hybrids with high productivity and good quality.

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INTRODUCTION

Legumes are an important source of protein in many countries of the world and the countries of the Near East and North Africa, and they are an essential source for some of them (Tewodros et al., 2015 and Gemechu et al., 2016). Alhadj et al., (2019) stated that China is one of the largest producers of Studies confirm that the Mediterranean basin is the original home of faba bean, followed by Ethiopia, and Egypt is considered one of the main Arab countries in the production of Studies confirm that the Mediterranean basin is the original home of seed faba bean, and it is next to Ethiopia. In Iraq alone, the local production of Iraq for the remainder and according to the governorates reached 49.861 tons of green pods, with a cultivated area of 24966 dunums, with an average productivity of 1997.2 kg/dunum (Central Statistical Organization, 2019). The percentage of protein in dietary legumes ranges between (20-40%), which contain important amino acids such as Methionine and Cystine, and the percentage of protein varies among the different types, which are controlled by genetic s and environment (Asnakech et al., 2016 and Mesfin, 2019). Faba bean (*Vicia faba* L.) is one of the most important crops of the leguminous family Fabaceae, and its importance stems from its use as food for humans because its pods and seeds contain essential nutrients important for humans, such as carbohydrates, amino acids, vitamins, fatty substances and

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a number of other nutrients (Gnanasambandam et al., 2012 and Sallam et al., 2015). As well as their seeds contain a high protein content (Kumar, 2016), this makes this crop of nutritional importance necessary to compensate for the high price of animal protein (Abdul-Halitan, 2010 and Fekadu et al., 2012). Its plant residues are also used as feed for livestock feeding, in addition to its importance in increasing soil fertility and improving its granular composition, as it is included in agricultural rotations due to the ability of this crop to stabilize free atmospheric nitrogen in the soil by means of root nodes of pests , Currently, soil acidity is a major constraint of faba bean production in the highlands of Ethiopia as it associates with low nutrient availability (Endalkachew et al. 2018 ; Mesfin et al. 2019 ; Mesfin, 2020 a,b).

GENETIC PARAMETERS

Heterosis

The phenomenon of heterosis is one of the genetic parameters that plant breeders have applied in many crops, including legumes, in order to improve their productivity in quantity and quality, this phenomenon is considered as a method for direct selection of hybrids that are characterized by high yield, abundance in vegetative growth, regularity and homogeneity of their plants. This phenomenon has been studied in plants of the leguminous family, including faba bean, by a number of researchers, AL-Hamdany (2012) found a significant heterosis of P.H. , G.P.Y. , S.Y. and B.Y.. Bishnoi et al. (2012) It was found that there is a significant heterosis for the N.S.P.P. and the S.Y.. Bishnoi (2016) found a significant heterosis of the traits of N.S.P.P. , W.100 S. and S.Y.. Abdalla et al. (2017) obtained significant heterosis for the P.H. , N.B.P and S.Y. . Abd El-Mageed (2018) obtained hybrids that were significantly superior to the average of the two parents in the rest for the traits, F.D. , N.P.P. , P.L. , S.Y. and B.Y.. Valentin, and Georgieva (2019) found a significant heterosis for the characteristics of F.D. and S.Y..

Combining Ability

The idea of using G.C.A. and S.C.A. was suggested by Sprague and Tatum (1942), who were the first to use diallel crosses to obtain variance of the G.C.A. and S.C.A. of coalescence in order to infer from them the type of gene action, and for the purpose of determining the best parents to use in breeding programs. It gives an indication of a dominant gene action (Ejigu et al., 2016). Faba bean are one of the crops dealt with in studies of this type, and their results differed according to the different types, varieties and breeding methods used in the study Ibrahim (2010) found in a significant G.C.A. and S.C.A. of P.H. characteristics , N.B.P , N.P.P. , W.100 S. and S.Y. .Al-Shakarchy (2011) indicated a significant G.C.A. effect of the F2 hybrids of the characteristics of the N.B.P and G.P.Y. . Haridy and Amein (2011) showed that the mean squares of the G.C.A. and S.C.A. values were significant for P.H. , N.B.P , F.D. , N.P.P. , P.L. and S.Y. .The combining ability was studied in faba bean and it was found that there are significant G.C.A. and S.C.A. for P.H. , N.B.P , N.P.P. and S.Y. (El-Harty et al., 2011). Mourad et al. (2011) obtained significant square averages for G.C.A. and S.C.A. of P.H. characteristics , N.B.P. and F.D. . AL-Hamdany (2012) obtained G.C.A. and S.C.A. effect of P.H. , S.Y. , B.Y. and G.P.Y. . It was found that the ratios obtained between G.C.A. and S.C.A. to coalesce exceeded the correct one for the trait of F.D. , indicating the importance of the additional gene action in inheriting this trait (Abd-Elrahman et al., 2012). Hazem et al. (2013) reached a significant G.C.A. and S.C.A. for S.Y. . Zeinab and Helal (2014) reported that the mean squares of the G.C.A. and S.C.A. in the rest were significant for the G.P.Y. trait. Ismail (2016) evaluated six generations of pests and reached the importance of non-additive gene action in the heritability of the two traits: W.100 S. and S.Y. . Raid and AL-Joboory (2017) found that the mean squares of the G.C.A. were significant for P.H. , N.P.P. , S.Y. and B.Y.. Bishnoi (2018) concluded in faba bean that the mean squares of the G.C.A. were significant for the characteristics of N.P.P. , N.S.P.P. and G.P.Y.. Soad et al. (2018) evaluated twenty-four pure strains of faba bean and found significant effects of the G.C.A. and S.C.A. of the M.D. and G.P.Y. traits. Seif and Mohamed (2018) found a significant G.C.A. and S.C.A. was for F1 and F2 hybrids of S.Y. and G.P.Y. . Noor et al. (2019) concluded that the mean squares of the G.C.A. were significant for P.H. characteristics , N.B.P , F.D. , S.Y. and B.Y.. Saleh et al. (2020) It was found

that there are significant effects of the G.C.A. and S.C.A. in the P.H. , P.L. , N.P.P. , W.100 S. and S.Y. .

Phenotypic , Genetic and Environmental Variance

The researchers have worked to divide the phenotypic variance into environmental variance , which is the difference between plants with similar genotypes and cultivated in different environmental conditions, The appearance of the trait is the final result of the overlap of genotype and environment, and genetic variance , which is the difference between plants with an asymmetric genotype grown under a single or controlled environment (Sahoki, 1990).

Fikreselassie and Seboka (2012) in obtained high genetic variance of W.100 S. . Al-Taweel et al. (2019) indicated high genetic and phenotypic variance of P.H. characteristics , W.100 S. , S.Y. and B.Y. . Fatih (2020) concluded that the coefficient of genetic and phenotypic variance was high for the F.D. , P.H. , N.S.P.P. , W.100 S. and S.Y.. It is an estimate of phenotypic and genetic variances in faba bean it was found that the genetic and phenotypic variances , as well as coefficient of genetic and phenotypic variance , were high for the characteristics of the N.B.P , N.P.P., G.P.Y. , S.Y. and B.Y.. This is in agreement with what has been obtained (Ahmad, 2016 and Praveen et al., 2017 and Fatih et al., 2017 and Behailu et al., 2018).

Heritability and Expected Genetic Advance

Two concepts of heritability have been defined, the first of which is heritability ratio in the narrow sense in which only additive genetic variance enters, the second is the heritability ratio in the broad sense, and the total genetic variance is taken into account (Allard, 1960). The first concept is more accurate in determining the electoral program, and both types of inheritance are important for plant breeders, and the estimation of which of them depends on the breeding material that the plant breeder works on, which is the measure of the relationship between parents and children (Lush, 1943).

One of the objectives of the plant breeding and improvement programs is to obtain high-yielding, good-quality varieties. Among these programs is the selection that was used in all crops, as it was developed through several desirable varieties, selection is affected by both the variance in the community in which selection is required and the intensity of selection and heritability , where these factors enter into the equation of estimating the expected genetic advance of the quantitative trait, and estimating the genetic advance is the largest application of the quantitative genetic theory in plant breeding and improvement programs, Johanson et al. (1955) indicated that the expected genetic advance is a product of both the selection intensity, heritability and the phenotypic standard deviation.

Al-Shakarchy (2010) found high heritability for the N.P.P. , B.Y. and S.Y. .Mulualem et al. (2013) indicated a high genetic advance of G.P.Y. . Sheelamary and Shivani (2015) found a high heritability of P.H. , N.B.P , W.100 S. , B.Y. and S.Y. . Abd El-Zaher (2016) obtained a high heritability of P.H. , N.B.P and W.100 S. . Amit et al.(2020) reach a high heritability of P.H. , N.B.P and N.P.P.. The expected genetic advance values are also associated with the inheritance rate in a broad sense (Singh and Chaudhary, 1985). Where it was high for the characteristics of N.P.P. , G.P.Y. , S.Y. and B.Y. . This is in agreement with what was mentioned (Bakhiet et al. 2015 and Sharifi, 2015 and Hamza, 2017 and AL-Hamdany, 2017 and Bishnoi et al. 2018 and Al-Shakarchy et al. 2020)

Whereas

Plant Height (P.H.) , Green Pods Yield (G.P.Y.) , Seed Yield (S.Y.) , Biological Yield (B.Y.) , NO.of Seeds Per Pod (N.S.P.P.) , Weight of 100 Seeds (W.100 S.) , NO.of Branches.Plant-1 (N.B.P) , Flowering Date (F.D.) , Maturity Date (M.D.) , NO.of Pods.Plant-1 (N.P.P.) , Pod Length (P.L.)

CONCLUSIONS

Selection for higher yields in crops, including the faba bean, requires knowledge of the nature and amount of variance in germplasm because genetic differences are desirable for plant breeders, The success of any breeding program must depend on the desired genetic variants that are present in the plant community, and had it not been for the occurrence of these variants, the plant

species that surpassed their parents in productive and qualitative characteristics would not have been found.

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دراسة بعض المعالم الوراثية في الباقلاء

محمد صبحي الطويل ونام يحيى رشيد الشكرجي

قسم المحاصيل الحقلية – كلية الزراعة والغابات – جامعة الموصل – الموصل -العراق

الخلاصة

تأتي أهمية تقدير المعالم الوراثية في معرفة كيفية انتقال العوامل الوراثية من جيل إلى آخر فضلاً عن علاقتها ببعضها وتأثيرها في تحديد المظهر الخارجي للنبات ، وذلك من خلال معرفة السلوك الوراثي وطبيعة الفعل الجيني الذي يمثل أهمية كبيرة في تحديد الطريقة المناسبة للتربية والتحسين. يتطلب الانتخاب للحصول العالي في المحاصيل ومنها الباقلاء معرفة طبيعة التباين ومقداره في الأصول الوراثية لأن الاختلافات الوراثية هي المرغوبة بالنسبة لمربي النبات ، وإن نجاح أي برنامج للتربية يجب أن يعتمد على المتغيرات الوراثية المرغوب بها والموجودة في المجتمع النباتي ، ولولا حدوث هذه المتغيرات لما وُجدت الأنواع النباتية التي تفوق آباءها في الصفات الإنتاجية والنوعية. وبالنظر للطلب المتزايد على محصول الباقلاء كمصدر غذائي وطبي مهم للإنسان ، فضلاً عن عدم وجود محطات تربية تعني بالمحافظة على الأصناف المزروعة في القطر أو استنباط أصناف جديدة ذات مواصفات إنتاجية ونوعية مرغوبة ولغرض النهوض بالواقع الحالي لإنتاج هذا المحصول فقد كرس الباحثين جهودهم لاستغلال ما توفر لديهم من وسائل ومعلومات وراثية كرافد من روافد تربية وتحسين هذا المحصول ، حيث اهتم الكثير من مربي النبات بظاهرة قوة الهجين وتم استغلالها في استنباط الكثير من الهجن ذات الإنتاجية العالية والنوعية الجيدة.

الكلمات المفتاحية:

قوة الهجين ، الباقلاء ، المعالم الوراثية .