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Correlation Studies in Yield and Some Yield Components of Black Cumin (*Nigella sativa L.*) Landraces Evaluated at Southeastern Ethiopia

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Abstract

Many research works done on Black Cumin focused on its nutritional and medicinal properties. As a result, there is no information on the association of its yield and yield components. Therefore, correlation analysis was made on twenty Black Cumin landraces evaluated at Goro and Ginir districts of Bale in randomized complete block design with three replications during 2011 and 2012 to quantify the relationship between yield and yield components. The result of the analysis showed that seed yield is positively correlated with plant height (0.40), number of capsules per plant (0.12), number of primary branches per plant (0.05) and number of seeds per capsule (0.01) in their respective order of strength of correlation. This could be an indication for the selection program of Black Cumin to focus mainly on plant height and number of capsules per plant if the intension is to go for high yield. On the other hand, seed yield showed negative correlation with days to flower, days to maturity and biomass yield.

Keywords: Correlation; Black cumin; Seed yield; Yield components

Introduction

Black Cumin (*Nigella sativa* L.) is an annual herbaceous plant belonging to the family Ranunculacea [1]. It has been used since antiquity for culinary, seasoning and pharmacological purposes [2]. It has anticancer and antimicrobial activity. Its seed constituents have unique chemical properties with more than one hundred different chemical components [3]. It is also a valuable source of carbohydrates, proteins, essential fatty acids, vitamins, and minerals. Because of its characteristics properties, there is an increasing demand in the domestic and international markets [2]. Black Cumin is one of the seed spices grown in Ethiopia having a commercial demand both in the domestic as well as in the international market. It is one of crops chosen in the specialization program to be produced by selected potential districts. Hence, increasing its seed yield is one of the areas need to be addressed in the fulfillment of the objectives of the specialization program.

Seed yield is a complex trait whose production is influenced by its component traits directly or indirectly. Breeder is certainly interested in investigating the extent and type of association of such traits [4] for they contribute valuable information in breeding for yield. Knowledge of the association of yield and its components traits will enable a breeder to know how the selection pressure exerted by him on one trait will cause changes in other traits. Thus, quantification of the association between yield and its components is crucial in breeding for a certain crop. For the purpose of quantification of relationships among traits in crop plants correlation and regression analyses are used [5]. Correlation is logical step towards a clear understanding of the type of plant traits [4]. Correlation analysis quantifies the relationships between any given pair of traits without regards to cause/effect relationship [5]. Unfortunately, the research works so far done on Black Cumin mainly focused on its nutritional and medicinal properties. As a result, there is no information on phenotypic relationship among yield and yield components. Therefore, the objective of this study was to quantify the phenotypic relationship between yield and yield traits in black cumin in order to gain representative results for efficient future selection and improvement.

Materials and Methods

Twenty landraces of Black Cumin, collected from Arsi-Bale, were evaluated at Goro and Ginir during 2009 and 2010 in RCBD with three replications. The land races were sown on a plot area of 2.4 m^2 having four rows which are 30 centimeters apart and 2 meter long.

The variables were gathered from five plants selected randomly from the middle rows from each replication at harvest. These variables are expressed below.

Days to flower: Days to flower was recorded on plot basis when 50% of the plants get flowered.

Plant height (cm): Average height in centimeter measured from ground level to the tip.

Number of capsules per plant: Average number of seed bearing capsules from the five plants.

Numbers of primary branches: Average number of primary branches from the five plants.

Secondary branches per plant: Average number of secondary branches from the five plants.

Days to maturity: number of days to reach physiological maturity, on plot basis, was recorded when capsules turned brown.

Numbers of seeds per capsule: Average number of seeds from three randomly selected capsules from the five plants.

Seed yield per plant (g): Average seed yield in gram from the five plants.

Phenotypic correlation coefficients were estimated according to Singh and Chavdhury [6].

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Data analysis

The average of traits recorded from the five randomly selected plants in each replication was subjected to correlation analysis using SAS version 9.2 [7] on the mean of the traits under study.

Results and Discussion

The result of the correlation analysis of seed yield and its component traits was indicated in Table 1. The result of the correlation analysis indicated that there was none significant correlation between seed yield and all the traits studied. Seed yield is positively correlated with plant height (0.40), number of capsules per plant (0.12), number of primary branches per plant (0.05) and number of seeds per capsule (0.01) respectively. This could be an indication for the selection program of Black Cumin to focus mainly on plant height and number of capsules per plant if the intension is to go for high yield.

On the other hand, seed yield is negatively correlated with days to flower (-0.22) and days to maturity (0.11). The negative correlation of seed yield to days to flower and days to maturity could be due to the abortion of flowers commonly occurring in Black Cumin. This problem arises from the nature of flowering of Black Cumin plants that did not flower at once. The flowering starts from the tip and progresses down to the bottom. Accordingly, earlier flowering plants have got much time for the whole flowers to develop into capsules bearing mature seeds by utilizing the available rainfall. On the other hand, the late flowering and hence, late maturing plants bear less capsules with mature seeds for much of their flowers get aborted as a result of rainfall shortage. The other nature of the crop that is contributing to its late maturing is the long time, about three weeks, needed for their seeds to germinate. This might be contributing to the reduction in seed yield by shortening the rainfall time that could be used for seed set and development. As a result, much of the flower could not develop into a capsule that bear mature seeds.

Days to flower had a negative correlation with number of primary of branches (-0.19), number of capsules per plant (-0.23), number of seeds per capsule (-0.07) and seed yield (-0.22) while it showed a positive correlation with plant height and days to maturity. The negative correlation of days to flower with number of capsules per plant might be due to fact that there was less number of flowers aborted in the earlier plants than late flowering plants and hence, more number of capsules bearing seeds.

Plant height showed significant positive correlation (0.48*) with primary branches per plant. It also had positive correlation with other traits studied. Number of primary branches per plant showed a highly significant and significant positive correlation with number of capsules per plant and number of seeds per capsule respectively. It had a positive and a negative correlation with seed yield and days to maturity respectively.

Number of capsules per plant showed a significant positive (0.34*), positive (-0.19) and negative correlation (0.12) with the number of seeds per capsules, days to maturity and seed yield respectively. Days to maturity showed negative correlation (-0.24) with seed yield and number of capsules per plant. This might be, again, due to abortion of much of the flowers without developing into capsules that bear mature seeds. The late maturing plants did not have enough time to convert their whole flowers into capsules that had mature seeds because of the rainfall shortage.

The present result also agrees with the work of Bradideh et al. [3] who reported positive correlation of yield with number of capsule per plant, number of seeds per capsule, plant height, number of main branch and number of sub branch. They also reported that positive correlation of plant height with number of capsule per plant and number of main branch. Mengasha et al. [8] also reported significant and positive correlation of seed yield with basal leaf number, plant height, seed per plant and thousand seed weight at genotypic level in Ethiopian Coriander accessions. Heritability study, path coefficient analysis and genotypic coefficient of variation are among the focus study area in the future.

	DF	PH	PB	CPP	SPCUP	DM	SY
DF	1						
PH	0.15	1					
PB	-0.19	0.48*	1				
CPP	-0.23	0.13	0.60**	1			
SPCUP	-0.07	0.32	0.28*	0.34*	1		
DM	0.11	0.14	-0.23	-0.19	0.11	1	
SY	-0.22	0.40	0.05	0.12	0.01	-0.24	1

*=Significant at 5% level of significance; **=Highly significant at 1% level of significance; DF=Days to flower (50%); PH=Plant height; PB=Primary branch; CPP=Number of capsules per plant; SPCUP=Number of seeds per capsules; DM=Days to maturity; SY=Seed yield per hectare (Kg)

Table 1: Correlation coefficients of the eight agronomic traits of black cumin landraces.

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