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Study of relationship between related yield traits using correlation and regression in wild barley *(Hordeum murynum)*

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ABSTRACT

Genotypic variation is useful to breeders when selecting genotypes to improve particular traits. In order to study of genetic diversity 20 genotypes of *Hordeum murynum* studied in the form of randomized complete block design the experimental field of islamic azad university shahre rey branch with 3 replication in the year 2012. Notes traits was conducted including days to heading, days to maturity, plant height, straw weight, harvest index, grain number per panicle, 10- panicle weight, 100- grain weight, biomass and grain yield. The results of analysis of variance showed that the significant differences were observed among genotypes for all morphological traits, except days to maturity and harvest index. Mean of traits classified using Duncan's multiple range test (p = 0.05). Line of 12-1092 produced the highest Plant height, days to heading, 10- panicle weight straw weight, biomass and grain yield. Correlation coefficients showed the grain yield has a positive at p= 0.05 and significant with biomass (r=0.97), number of nodes on the stem (r=0.72), 10- panicle weight (gr) and plant height. Stepwise regression analysis, grain yield as the dependent variable (Y) and other traits evaluated was considered as an independent variable (X). Results showed that the biomass and grain yield (with biomass) with 93.7% and 98.8% explained the maximum grain yield variation, respectively.

Key word; Barley, Correlation, Grain yield, *Hordeum murynum* and Regression.

INTRODUCTION

Barley is an important crop in the world, ranking fifth in the world production that is used for animals, malt, and human food (Khodabandeh, 2002). It's importance derives from the ability to grow and produce in margina environments, which are often characterized by drought, low temperature and salinity (Hayes *et al*, 2003; Baum *et al*, 2003). Wild barley possess high genetic variation in several useful characters including earliness, biomass yield, protein content, resistance against powdery mildew and leaf rust (Nevo, 1992). *Hordeum* L. is a widely distributed genus of the tribe Triticeae of the Poaceae (Graminae) family. There are about 45 species and subspecies, most of which represent weedy annual or perennial grasses, found throughout the temperate zones of both northern and southern hemispheres (Morrell,

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2003). The large genetic variability present in the wild cereals is an invaluable resource for cereal crop improvement. Assessment of the genetic diversity in a crop species is fundamental to its improvement. Genetic diversity among and within plant species is in danger of being reduced. In wild species genetic diversity may be lost because of severe reduction in population size, whereas in domesticated crops genetic diversity may be lost because of the narrow genetic base in many breeding programs (Kling *et al*, 2003; Cao *et al*, 1998). Estimates of genetic diversity can be based on different types of data. Phonological and morphological quantitative traits have frequently been used for studying genetic diversity in barley (Chand *et al*, 2008). Neyestani *et al* (2005) in study of 10 barley cultivars estimated that the correlation between the numbers of grains per spike with grain yield was positive. The purpose of this experiment was to determine the proportion of traits in determination of grain yield.

MATERIALS AND METHODS

In order to study of genetic diversity 20 genotypes of *Hordeum murynum* studied in the form of randomized complete block design the experimental field of islamic azad university shahre rey branch with 3 replication in the year 2012. Notes traits was conducted including plant height (cm), days to heading, number of grain per panicle, days to maturity, 10- panicle weight (gr), 100- grain weight (gr), harvest index, straw weight (gr), biomass (biological yield) (gr) and grain yield ($gr.m^{-2}$). Plants selected for sampling randomly within each block were experimental plots. To calculate the correlation coefficient of the mean traits were statistically analyzed for each experimental unit, also in order to evaluate the effect of reducing the number of independent variables and the fitted regression was used model, stepwise regression. Finally statistical calculations were performed using software SAS and $SPSS_{16}$.

RESULTS AND DISCUSSION

The results of analysis of variance (Table 1) showed that the significant differences were observed among genotypes for all morphological traits, except days to maturity and harvest index. Drikvand *et al* (2012) in Study of Genetic diversity among Barley Genotypes showed significant differences were observed among for morphological traits. Mean of traits classified using Duncan's multiple range test (p = 0.05). Line of 12-1092 produced the highest plant height (gr), days to heading, 10-panicle weight (gr) straw weight, biomass (gr) and grain yield ($gr.m^{-2}$). Number of grain in panicle and 100- grain weight was greatest in 1-826 and 6-986 lines, respectively (Table 2). There results showed that different genetic systems involved in controlling traits, which emphasized on important of study of these traits (Maktoobian *et al*, 2013; khajavi *et al*, 2014). Among descriptive parameters studied (Table 3) the highest coefficient of variation was the grain yield (49.01%), biomass (40.71%) and straw weight (39.63%), thus, range of traits is widely in genotypes. The lowest coefficient of variation was the days to maturity (1.32%) and days to heading (1.52%). Therefore, these traits have not suitable diversity in crop improvement . Correlation coefficients (Table 4) showed the grain yield higher for the same amount of biomass and straw weight, the number of nodes in the stem, height and weight is the most 10- panicle weight. The grain yield has a positive at *p*= 0.05 and significant with biomass (r=0.97), number of nodes on the stem (r=0.72), 10- panicle weight (gr) and plant height (cm), also the increase in each of these characteristics, increase grain yield. plant height had a significant and positive correlation with the straw weight (r=0.72), biomass (r=0.68), number of grains per panicle (r = 0.50) and grain yield (r=0.57). Therefore, Plant height is perfect for select genotypes with high yield. Furthermore, the use of straw for livestock feed, selection this trait can be a significant impact increase straw (Baniya *et al*., 1967; Zaheer., 2008). kole (2006) reported a significant grain yield per plant has positive correlations with, number of tillers, number of spikelet's spike and 100– grain grains weight. According to the same reports and contradictory results, it is obvious that determining the correlation rate of yield. The significant coefficient in the successful regression equation indicating these attributes are to be effective in increasing yield. In other words, with the increase of this specification, yield will also increase. Afzali Far *et al* (2011) according to the stepwise regression analysis traits such as total grain yield, biomass and plant height introduced as an effective traits on the yield. Dadashi *et al* (2010) using stepwise regression and at the 5% level three traits such as grain per spike, number of fertile tillers and seed weight introduced as an effective traits on the yield.

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Table 1. Analysis of variance different traits in 20 barely genotypes (n=20).

S.O.V	df	Plant height (cm)	Days to heading	Number of grain in panicle	Days to maturity	10-Panicle weight	100-Grain weight (gr)	Harvest index	straw weight (gr)	Biomass (gr)	Grain yield (gr.m^{-2})
Genotype	19	55.76**	18.94**	40.12**	9.01	1.08**	0.105**	40.86	2899.65**	6284.69**	709.39*
Replication	2	216.6**	30.21**	70.11**	23.21*	0.44	0.006	69.88	8135.39**	17638.52**	1867.82**
Error	38	20.84	5.05	4.36	5.41	0.28	0.03	42.04	1054.36	2324.66	320.10

* and **; Significant at p = 0.05 and p = 0.01 levels, respectively.

Table 2. Means of the estimated traits in 20 barely genotypes (n=20).

Lines	Plant height (cm)	Days to heading	Number of grain in panicle	Days to maturity	10-Panicle weight (gr)	100-Grain weight (gr)	Harvest index	Straw weight (gr)	Biomass (gr)	Grain yield (gr.m^{-2})
1-826	28.16af	147.33be	38a	177.33ac	3.01bf	0.86df	28.96ab	86.27b	122.03bc	35.75bc
2-828	27.66bf	143.67de	34ac	175.33ac	2.51df	0.82f	34.45ab	84.93b	130.8bc	45.86bc
3-833	24.16df	148bd	34.33ac	178ab	2.50df	0.75f	31.44ab	63.25b	91.44bc	28.20bc
4-943	31.33ae	147.33be	34.33ac	175ac	3.12be	0.80f	27.69ab	93.57b	130.28bc	36.70bc
5-985	26bf	۱۴۵.۶۷be	25e	176.33ac	3.21be	1.27ab	27.39ab	48.28b	68.36bc	20.08bc
6-986	20.66f	145.33be	24.33e	178.33ab	3.51bc	1.36a	27.62ab	54.61b	76.77bc	22.15bc
7-992	31.33ae	143.67de	31.33c	174.33ac	3.78b	0.84ef	35.28ab	104.01b	156.19b	52.02bc
8-1004	34.33ab	144.33ce	35.66ab	173c	2.42ef	0.88cdf	28.41ab	106b	146.01bc	40bc
9-1021	30.66ae	148bd	34.33ac	173c	3.4bd	1.21ac	30.58ab	83.09b	119.57bc	36.47bc
10-1085	24.66cf	144.33ce	27.33de	175ac	3.02bf	1.18ae	31.06ab	62.24b	91.34bc	29.1bc
11-1086	33.5ac	143.33e	34ac	173c	2.41ef	0.89cf	25.39b	86.16b	120.33bc	34.16bc
12-1092	36.66a	153a	32.66bc	178.67a	4.77a	1.08af	29.18ab	190.34a	276.68a	86.34a
13-1096	33.33ac	148.33bc	36.66ab	176.67ac	3.30be	0.94bf	30.76ab	92.75b	132.63bc	39.88bc
14-1146	31.66ad	144.67be	36.66ab	175.33ac	3.08be	0.87cf	30.46ab	79.59b	114.56bc	34.97bc
15-1171	22.33ef	149.33ab	30.66cd	176ac	3.77b	1.19ad	30.06ab	51.74b	77.05bc	25.31bc
16-1174	25.33bf	149ab	33bc	175.33ac	3.04bf	0.90cf	38.67a	81.97b	134.23bc	52.25b
17-1185	29.66ae	149.67ab	31.33c	175.67ac	2.16f	0.77f	24.9b	43.22b	59.58c	16.36c
18-1187	26bf	146.67be	33.66bc	174bc	2.78cf	1.01bf	33.91ab	80.91b	122.41bc	41.5bc
19-1199	26.33bf	149.67ab	34.66ac	175.33ac	3.04bf	0.83f	28.26ab	76.88b	108.09bc	31.2bc
20-1205	25.16cf	148.33bc	34.66ac	177.67ab	2.6df	0.76f	23.35b	68.46b	90.23bc	21.76bc

In each column, any two means having a common letter are not significantly different at p = 0.05 based on Duncan's multiple range test.

Table 3. Descriptive parameters of morphological traits in 20 barely genotypes (n=20).

traits	Plant height (cm)	Days to heading	Number of grain in panicle	Days to maturity	10-Panicle weight	100-Grain weight (gr)	Harvest index	Straw weight (gr)	Biomass	Grain yield ($gr.m^{-2}$)
Mean	28.45	147.08	32.83	175.67	3.07	0.96	29.89	81.92	118.43	36.5
Minimum	20.67	143.33	24.33	173	2.17	0.76	23.36	43.22	69.59	16.36
Maximum	36.67	153	38	178.67	4.77	1.36	38.68	190.34	276.68	86.34
Rang of variation	16	9.67	13.67	5.67	2.6	0.61	13.32	147.12	217.09	69.98
SD	431.38	2.51	3.65	1.73	0.6	0.18	3.69	310.88	457.69	153.77
‡ CV (%)	16.04	1.52	6.35	1.32	14.98	17.74	21.68	39.63	40.71	49.01

‡Coefficient of variation

Table 4. Correlation of traits in 20 barely genotypes (n=20).

	10- Panicle weight	100- Grain weight	Number of grain in panicle	Grain yield (gr.m^{-2})	Biomass (gr)	Harvest index	Straw weight (gr)	Plant height(cm)	Days to heading	Days to maturity	Number of nodes on the stem
10- Panicle weight (gr)	1										
100- Grain weight(gr)	0-.33	1									
Number of Grain in panicle	0-.24	0-.13	1								
Grain yield (gr.m^{-2})	0.58**	0-.31	0.27	1							
Biomass(gr)	0.57**	0-.31	0.33	0.97**	1						
Harvest index	.20	0-.32	0.07	0.47*	0.27	1					
Straw weight(gr)	0.55*	0-.30	0.35	0.93**	0.99**	0.16	1				
Plant height (cm)	0.14	0.04	0.50*	0.57**	0.68**	0-.10	0.72**	1			
Days to heading	0.40	0.24	0.20	0.26	0.28	0-.11	0.28	0.05	1		
Days to maturity	0.34	0.005	0-.19	0.03	0.05	0-.19	0.06	0-.31	0.49*	1	
Number of nodes on the stem	0.68**	0-.07	0-.07	0.72**	0.73**	0.21	0.71**	0.44	0.17	0.16	1

* and **; Significant at $p = 0.05$ and $p = 0.01$ levels, respectively.

Table 5. Stepwise regression for grain yield (dependent variable) and other traits (independent variable)

stage	Cumulative coefficient	F	The final coefficient
1	93.7	282.32**	0.32
2	98.8	769.90**	0.95

stage	trait	Width of source	The regression coefficient		Cumulative coefficient
			F	E	
1	Biomass	-2.07	-	0.32	93.7
2	Harvest index	-28.24	0.95	0.30	98.8

$y=-28.24+0.30\ X_1+0.95\ X_2$