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Determination of Some Characteristics of Cocksfoot (Dactylis glomerata L.) Populations Collected from Natural Areas of Eskisehir for Breeding Purposes

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ABSTRACT: *The aim of the research is obtaining material and information for breeding of new varieties which can be used as pasture and forage plant in Central Anatolia and resembling regions. Some of the cocksfoot (**Dactylis glomerata** L.) seeds, collected from natural areas in 2010-2011, and were sent with passport information to the Gene Banks in Ankara and Izmir. The rest of the seeds were grown in greenhouse and then transfered to the field. In 2012, 32 populations were identified by observing (according to 1-9 and 1-5 scale) and measuring some characteristics. Then, mean and standard error values of the obtained data were determined. The mean values of the populations in main stem length, main stem thickness, flag leaf length, flag leaf width, number of nodes, internode length, growth pattern, rust resistance, winter resistance and tillering capacity changed between 43.9-72.4 cm, 2.0-3.3 mm, 7.8-16.0 cm, 2.9-5.4 mm, 2.3-4.5, 7.5-16.0 cm, 6.4-8.8, 6.6-8.0, 4.7-8.3 and 5.4-8.1, respectively. The relations between the characteristics were examined by correlation analysis. Furthermore, ploidy levels of some single plants selected from the natural populations for breeding purposes were determined by flow cytometry analysis and all of these plants studied were found tetrapolid.*

Key words: *Cocksfoot, **Dactylis glomerata** L., collection, breeding, correlation, ploidy.*

Eskişehir'de Doğal Alanlardan Toplanan Domuz Ayrığı (Dactylis glomerata L.) Populasyonlarında Islah Yönünden Önem Taşıyan Bazı Özelliklerin Belirlenmesi

ÖZET: *Araştırmanın amacı, Orta Anadolu ve benzeri ekolojilerde yürütülen mera ıslah çalışmalarında kullanılabilecek yeni çeşitlerin geliştirilmesi çalışmalarına materyal ve bilgi üretmektir. 2010 ve 2011 yıllarında doğal alanlardan toplanan domuz ayrığı (**Dactylis glomerata** L.) tohumlarının bir kısmı durak bilgileri ile birlikte Ankara ve İzmir'deki Gen Bankalarına gönderilmiştir. Tohumların kalan kısmı serada fide haline getirildikten sonra araziye aktarılmıştır. 2012 yılında toplam 32 populasyon gözlem (1-9 ve 1-5 skalaları) ve ölçümlere tabi tutularak bazı özellikleri belirlenmiştir. Daha sonra verilerin ortalama ve standart hata değerleri saptanmıştır. Populasyon ortalama değerleri ana sap uzunluğunda 43,9-72,4 cm, ana sap kalınlığında 2,0-3,3 mm, bayrak yaprak boyunda 7,8-16,0 cm, bayrak yaprak eninde 2,9 -5,4 mm, ana saptaki boğum sayısında 2,3-4,5 adet, ana saptaki boğum arası uzunluğunda 7,5-16,0 cm, büyüme şeklinde 6,4-8,8, pasa dayanıklılıkta 6,6-8,0, kışa dayanıklılıkta 4,7-8.3 ve kardeşlenme potansiyelinde 5,4-8,1 arasında değişmiştir. Özellikler arasındaki ilişkiler korelasyon analizi ile incelenmiştir. Ayrıca ıslah çalışmaları için seçilen tek bitkilerin ploidi düzeylerinin saptanması amacıyla flow sitometri yöntemi ile analiz gerçekleştirilmiş ve çalışılan tüm bitkilerin tetraploid olduğu belirlenmiştir.*

Anahtar sözcükler: *Domuz ayrığı, **Dactylis glomerata** L., toplama, ıslah, korelasyon, ploidi.*

INTRODUCTION

Although flora of Turkey is quite rich in terms of pasture grasses, imported varieties are used in pasture establishment, generally. There have been difficulties in adapting these varieties to different ecological conditions of the country (Oral and Acikgoz, 2002). Use of imported varieties is an important problem for the country's economy, as well. For these reasons domestic varieties are needed which are adaptable to different ecological conditions of the country. Collection and characterization of ecotypes widely found in natural areas of the country is an important resource for the development of ecologically adaptable varieties. It is reported that these natural ecotypes could be used in variety development studies using selection method (Tosun, 1973).

Coksfoot (*Dactylis glomerata* L.) is a perennial cool season grass used as pastures and forage plant. The species, which is resistant to drought and cold, can also tolerate shadow to a certain extent. The species show a rapid spring development (Manga *et al*., 2002). It is an economically important species with high yield as pasture and forage crop. When it is grazed or harvested in vegetative period, its feed quality and taste is high. Even when cultivation conditions are not ideal, it is easy to establish and grow rapidly. Cocksfoot is very resistant to cutting and grazing and is also used in erosion control (Alizadeh and Jafari, 2011).

MATERIALS AND METHODS

In this study, there have been presented some results of observations and measurements conducted in the ecotypes collected from natural areas to provide sources for breeding studies of pasture and forage type cocksfoot varieties for Eskisehir and similar ecologies.

The collected materials were characterized in terms of some properties and some single plants were selected for breeding purposes. Then, polidy levels of the collected material were determined using flow cytometer method. It has been reported that determination of ploidy levels of ecotypes collected from natural areas is important when these plants are used in plant breeding studies (Hatipoglu *et al*., 1994). Rapid and reliable results are obtained with flow cytometry in cases where the ploidy level of a large number of plants, such as plant genetic resources, need to be determined. The method is widely used in determining DNA content and ploidy level of many grass species (Wang *et al*., 2009).

The collection and characterization studies were carried out in 2010, 2011 and 2012 in Eskisehir Province and at the Central Field of Transitional Zone Agricultural Research Institute. Climate data were given in the table below (Table 1). According to long term climate data, the area receives 347 mm precipitation and experiences an average monthly temperature 10.8 °C and 77.7% relative humidity. In the years our research was conducted, precipitation and average relative humidity were higher than long term data.

According to the analysis results of the soil taken from the germplasm area, experimental area is slightly alkaline, clayey, with medium limy, slightly salty, rich in potassium and rich in phosphorus (Table 2).

In the collection study in 2010, single plant seeds were collected from the stations determined for each 10 km considering altitude and direction in Eskisehir Province (Alan, 1986). In addition, they were collected in sheltered areas such as village cemeteries where these plants are concentrated. In the study, the factors such as soil type, soil slope, soil appearance, and their relation with vegetation were considered. Selections also were made according to the characteristics such as general appearance of plant (upright, decumbent etc.), color, and plant height. During the collection, information such as coordinates, altitude, region or local name and distance to the nearest settlement were recorded (Table 3).

The collected seeds divided into 3 parts and one part was sent to the Gene Banks in Izmir and

Ankara with the station information data. One part has been preserved in the Institute. The rest of the seeds were grown in greenhouse and the seedling transferred to field separately for each single plant. There were 20 plants for each single plant (population) collected from natural areas but some were lost due to winter and diseases.

These populations were subjected to the observations and measurements:

Main stem length (cm), main stem thickness (mm), flag leaf length (cm), flag leaf width (mm), number of nodes, internode length (cm), growth pattern (1: oblique – 9: upright), rust resistance (1: susceptible – 9: resistant), winter resistance (1: susceptible - 9: resistant), and tillering capacity (1: poor – 9: abundant) (Tosun, 1973; Tokluoglu, 1979; Demiroglu *et al*., 2008; Anonymous, 2016).

The obtained data were subjected to statistical analysis and population averages and standard errors were determined. Standard error values were determined to indicate whether there is a variation between the single plants in population. In addition, a correlation analysis was conducted to determine the relations between the characteristics (Kackar and Harville, 1984; Pearson, 1920).

The selected plants for breeding purposes according to the observations and measurements were subjected to a ploidy analysis using flow cytometer method in 2015. In the method, ploidy levels were determined using the core DNA content of plants. Flow Cytometer device in Trakya University, Agricultural Faculty, Field Crops Department was used in the analysis which determines DNA content rapidly and accurately (Wang *et al*., 2009).

Table 1. Monthly precipitation, mean temperature and relative humidity in Eskisehir, Turkey.
Çizelge 1. Eskişehir İli aylık toplam yağış, ortalama sıcaklık ve oransal nem değerleri, Türkiye.

Month Aylar	Precipitation (mm) Toplam yağış (mm)			Temperature (^{0}C) Ortalama sıcaklık (C^0)			Relative humidity (%) Ortalama oransal nem (%)		
	2010	2011	2012	2010	2011	2012	2010	2011	2012
January / Ocak	36.0	26.6	58.0	1.5	0.3	-3.6	95.2	97.0	96.8
February / Şubat	42.6	8.9	42.1	4.9	0.1	-5.5	90.5	93.2	97.3
March / Mart	32.6	20.0	56.4	5.9	3.7	1.5	85.5	88.0	87.7
April / Nisan	23.9	56.9	22.1	9.2	7.2	12.0	84.3	91.0	72.6
May / Mayıs	20.7	145.8	80.9	15.2	0.5	14.4	70.4	87.7	83.3
June / Haziran	79.0	9.4	0.0	18.1	16.6	20.0	82.8	84.6	71.6
July / Temmuz	7.4	8.5	5.5	22.0	21.6	22.8	75.4	70.8	68.1
August / Ağustos	0.9	0.0	3.5	24.4	20.0	20.8	66.2	73.5	65.1
September / Eylül	22.5	2.1	0.0	18.2	17.4	18.7	75.8	68.5	66.1
November / Ekim	77.1	57.9	16.1	10.0	8.5	14.2	92.5	83.6	78.1
October / Kasım	7.5	0.0	14.5	9.3	0.8	7.3	81.0	86.8	92.3
December / Aralık	60.4	46.1	73.2	4.2	0.9	2.2	94.1	92.1	95.1
Total / Toplam	410.6	382.2	372.3						
Mean / Ortalama				11.9	8.1	11.0	82.8	84.7	81.2

*Meteorological Station of Transitional Zone Agricultural Research Institute.
*Geçit Kuşağı Tarımsal Araştırma Enstitüsü Meteoroloji İstasyonu.

Table 2. Germplasm area soil analysis.
Çizelge 2. Gözlem bahçesi toprak analizi.

Soil Structure Toprak yapısı	pH	Total Salt (%) Toplam tuz (%)	Lime (CaCO3) (%) Kireç (%)	Organic matter (%) Organik Madde (%)	Phosphorus (P_2O_5 - kg /da) Alınabilir fosfor (P_2O_5 - kg /da)	Potassium (K_2O - kg /da) Alınabilir potasyum (K_2O - kg /)
clayey killi	7.7	0.153	6.6	1.28	13.0	199.5

*Soil and Water Laboratory of Transitional Zone Agricultural Research Institute.
*Geçit Kuşağı Tarımsal Araştırma Enstitüsü Toprak ve Su Laboratuvarı.

Table 3. Station Information.
Çizelge 3. Durak bilgileri.

Population Number Populasyon Numarası	District İlçe	Collection site Toplama yapılan yöre	Latitude Enlem	Longitude Boylam	Altitude Yükseklik (m)
18	Sarıcakaya	Hamamlar-8 km to Taskopru	39.96086 °N	30.60667 °E	895
19	Sarıcakaya	Between Kuplu and Mayıslar-Village Grassland	40.00984 °N	30.66778 °E	784
20	Sarıcakaya	Between Kuplu and Mayıslar- Village Grassland	40.00984 °N	30.66778 °E	841
21	Sarıcakaya	Lacin Gobet-Village Grassland	40.02741 °N	30.80047 °E	1110
22	Sarıcakaya	Hamamlar-8 km to Taşköprü	39.96086 °N	30.60667 °E	895
23	Sarıcakaya	Lacin Gobet-Village Grassland	40.02741 °N	30.80047 °E	784
24	Mihalgazi	The Thermal Springs-500 m to Hamamlar	39.99404 °N	30.57988 °E	1022
25	Mihalıççık	Nallıhan Road 6. km-In Forest	39.90051 °N	31.43271 °E	1009
26	Sarıcakaya	3 km from Hekimdagı	39.90996 °N	30.62989 °E	1110
27	Mihalgazi	The Thermal Springs-500 m to Hamamlar	39.99404 °N	30.57988 °E	859
28	Mihalıççık	Nallıhan Road 6. km-In Forest	39.90051 °N	31.43271 °E	895
29	Seyitgazi	Han Road 10. km-Village Grassland	39.37383 °N	30.71631 °E	1036
30	Sarıcakaya	Lacin Gobet-Village Grassland	40.02741 °N	30.80047 °E	1224
31	Mihalıççık	The Road between Hamitoglu and Mihalıccık road 10. km-Grassland	39.82811 °N	31.47028 °E	1036
32	Mihalıççık	The Road between Hamitoglu and Mihalıccık road 10. km-Grassland	39.82811 °N	31.47028 °E	908
33	Sarıcakaya	Catacık Forest-Bride Fountain	40.02518 °N	30.78618 °E	784
34	Han	Afyon Road 4. km-Grassland	39.12894 °N	30.83604 °E	784
35	Seyitgazi	Han Road 10. km-Village Grassland	39.37383 °N	30.71631 °E	793
36	Inonu	Cemetery-Side of Aviation Facilities	39.81391 °N	30.12539 °E	356
37	Sarıcakaya	200 m from Eldem Houses-Village Cemetery	39.96145 °N	30.67784 °E	356
38	Sarıcakaya	200 m from Eldem Houses-Village Cemetery	39.96145 °N	30.67784 °E	552
39	Mihalıççık	The Road between Hamitoglu and Mihalıccık yolu 10. km-Grassland	39.82811 °N	31.47028 °E	793
40	Mihalıççık	The Road between Hamitoglu and Mihalıccık yolu 10. km-Grassland	39.82811°N	31.47028 °E	552
41	Merkez	3 km to Yahnikapan Village-Village Grassland	39.63041 °N	30.80647 °E	341
101	Merkez	Uludere-Village Cemetery	39.91566 °N	30.33850 °E	1025
102	Seyitgazi	Yazılıkaya-In front of the Monument	39.20018 °N	30.71504 °E	1292
103	Tepebaşı	Beklese Village-Village Grassland	39.99625 °N	31.00135 °E	1240
104	Mihalıççık	Gurleyik Village-Village Grassland	39.98858 °N	31.35383 °E	737
105	Mihalıççık	Karacaoren-Forestry Directorate Campus	30.00086 °N	31.09726 °E	1200
106	Mihalıççık	Otluk Village-Village Cemetery	40.01382 °N	31.12761 °E	1250
107	Merkez	Uludere-Village Cemetery	39.91566 °N	30.33850 °E	1025
109	Sivrihisar	Dumluca Village-Village Cemetery	39.38353 °N	31.25529 °E	1136

RESULTS

The mean values and standard errors of the characteristics of 32 cocksfoot populations are given below (Tabel 4). As stated before, the number of the plants in each population which initially is 20 decreased due to winter and disease damage. At the end of the observations and measurements, the mean values of the populations in main stem length, main stem thickness, flag leaf length, flag leaf width, number of nodes, internode length, growth pattern, rust resistance, winter resistance and tillering capacity changed between 43.9-72.4 cm, 2.0-3.3 mm, 7.8-16.0 cm, 2.9-5.4 mm, 2.3-4.5, 7.5-16.0 cm, 6.4-8.8, 6.6-8.0, 4.7-8.3 and 5.4-8.1, respectively.

Table 4. The mean values and standard errors of the cocksfoot populations.
Çizelge 4. Domuz ayrığı populasyonlarına ait ortalama ve standart hata değerleri.

pop. no pop. num.	plan. num. bit. say.	fll byb	flw bye	msl asu	mst ask	nn asbs	il asbau	gp bş	rr phd	wr kd	tc kp
18	11	13.6±1.1	4.4±0.2	69.5±2.6	2.5±0.2	4.5±0.2	9.6±0.4	8.6±0.2	7.0±0.0	8.0±0.0	7.5±0.3
19	14	14.0±1.4	5.1±0.3	71.4±3.7	2.9±0.1	3.2±0.2	13.5±0.6	8.4±0.4	6.7±0.2	8.0±0.0	7.2±0.3
20	13	14.8±1.6	4.2±0.3	68.8±3.2	2.8±0.1	3.3±0.2	13.6±0.5	7.4±0.4	7.0±0.0	8.0±0.0	7.4±0.2
21	15	10.2±0.7	3.5±0.3	63.4±3.1	2.5±0.1	3.4±0.1	12.0±0.7	7.7±0.3	6.7±0.1	8.0±0.0	7.5±0.3
22	11	11.0±1.3	3.8±0.3	65.3±2.3	2.5±0.2	3.5±0.2	12.1±0.7	7.5±0.3	6.8±0.2	7.8±0.1	7.3±0.2
23	13	14.1±1.0	4.4±0.3	69.9±2.5	2.6±0.1	3.5±0.1	12.5±0.8	7.6±0.2	7.0±0.0	7.9±0.1	7.4±0.2
24	17	13.2±1.2	4.0±0.3	72.4±2.4	2.4±0.1	3.6±0.2	13.7±0.9	6.4±0.3	6.9±0.1	8.2±0.1	7.5±0.2
25	16	9.0±0.8	3.1±0.3	50.0±4.3	2.2±0.1	2.9±0.1	12.0±0.6	7.8±0.3	7.0±0.0	7.9±0.1	7.9±0.1
26	13	11.4±1.4	4.3±0.3	69.2±3.2	2.8±0.2	3.2±0.2	13.1±0.8	8.8±0.2	7.0±0.0	8.0±0.0	7.9±0.2
27	18	14.0±1.2	3.8±0.3	71.5±2.3	2.6±0.1	3.5±0.2	12.0±0.6	7.4±0.3	6.6±0.1	8.0±0.0	7.4±0.2
28	18	7.8±0.7	2.9±0.2	45.3±2.0	2.2±0.1	2.9±0.2	9.1±0.7	7.8±0.2	7.0±0.0	8.3±0.1	7.8±0.2
29	16	10.9±0.8	4.3±0.3	59.4±2.6	2.8±0.1	2.4±0.1	14.5±0.8	8.2±0.3	6.9±0.1	8.3±0.1	7.0±0.0
30	17	16.0±0.2	5.3±0.3	72.4±1.4	3.3±0.2	3.2±0.1	14.0±0.8	7.5±0.2	6.9±0.1	8.0±0.0	7.9±0.2
31	6	9.8±0.9	3.5±0.3	49.2±2.6	2.2±0.4	3.8±0.1	7.5±0.7	8.3±0.3	7.0±0.0	8.0±0.0	7.0±0.4
32	14	10.3±1.2	3.4±0.3	60.0±2.9	2.6±0.1	3.5±0.2	9.9±0.6	8.5±0.2	7.0±0.0	8.0±0.0	7.0±0.0
33	9	8.4±0.9	3.2±0.4	56.7±3.8	2.3±0.2	3.2±0.2	11.0±1.3	8.0±0.3	8.0±0.0	8.0±0.0	8.1±0.1
34	13	13.8±1.2	3.6±0.4	66.0±2.4	2.4±0.1	2.9±0.2	14.7±1.0	7.5±0.3	6.9±0.1	6.8±0.2	6.6±0.1
35	16	10.1±0.7	3.6±0.3	63.3±2.7	2.4±0.1	2.9±0.1	16.0±0.8	6.9±0.3	7.0±0.0	8.0±0.0	8.0±0.0
36	14	8.3±1.0	3.0±0.3	66.5±2.1	2.6±0.1	3.7±0.2	11.6±1.0	8.0±0.3	7.0±0.0	8.0±0.0	7.9±0.1
37	14	11.4±1.1	4.4±0.3	64.7±4.1	2.9±0.2	3.9±0.2	12.9±1.1	6.7±0.3	7.0±0.0	8.0±0.0	7.2±0.2
38	19	12.3±1.1	3.8±0.2	64.2±1.8	2.7±0.1	3.4±0.2	12.1±0.6	6.8±0.3	8.0±0.0	8.0±0.0	8.0±0.2
39	19	11.1±0.1	3.5±0.2	60.8±1.8	2.7±0.2	3.1±0.2	13.2±0.6	7.4±0.2	7.1±0.1	8.0±0.0	6.8±0.2
40	15	9.4±0.8	3.0±0.1	56.1±1.3	2.5±0.2	3.1±0.2	12.5±0.7	8.0±0.1	6.9±0.1	7.7±0.1	7.0±0.0
41	10	9.4±1.1	3.6±0.3	43.9±1.7	2.3±0.2	2.3±0.2	10.0±0.7	7.3±0.2	7.0±0.0	8.0±0.0	6.7±0.2
101	16	10.9±0.9	5.4±0.3	64.2±1.5	3.1±0.2	2.8±0.1	13.6±0.8	7.6±0.1	7.0±0.1	5.6±0.2	6.0±0.2
102	19	11.0±0.9	4.8±0.3	61.9±2.1	2.5±0.1	2.5±0.1	14.1±0.8	7.1±0.1	7.0±0.0	5.7±0.2	5.9±0.2
103	19	9.6±0.7	4.6±0.2	53.7±1.5	2.3±0.1	2.4±0.2	11.9±0.9	6.8±0.1	7.0±0.0	5.9±0.2	5.9±0.1
104	20	12.3±1.0	4.7±0.2	64.4±1.7	2.7±0.2	3.3±0.2	13.0±1.1	7.0±0.1	6.7±0.1	5.8±0.2	6.1±0.1
105	18	9.2±0.4	4.4±0.2	55.9±1.5	2.6±0.1	2.8±0.2	11.6±0.8	6.9±0.1	6.9±0.1	5.8±0.1	6.3±0.1
106	20	10.5±0.6	4.4±0.2	64.6±2.3	2.4±0.1	3.0±0.2	13.8±0.9	7.2±0.1	6.9±0.1	5.9±0.1	6.3±0.1
107	20	8.1±0.8	4.0±0.2	53.9±1.4	2.3±0.1	2.6±0.2	13.1±1.0	6.9±0.1	7.0±0.0	5.7±0.1	5.9±0.1
109	11	8.3±0.9	4.2±0.1	46.9±1.6	2.0±0.0	2.4±0.2	11.5±0.3	6.6±0.2	7.0±0.0	4.7±0.4	5.4±0.3

*pop no.=populations, plan. num.=the plant number in populations, fll=flag leaf length, flw=flag leaf width, msl=main stem length, mst=main stem thickness, nn=number of nodes, il=internode length, gp=growth pattern, rr=rust resistance, wr=winter resistance, tc=tillering capacity.
* pop. num.= populasyon numarası, bit. say.= populasyon içindeki bitki sayısı, byb= bayrak yaprak boyu, bye= bayrak yaprak eni, asu= ana sap uzunluğu, ask= ana sap kalınlığı, asbs= ana sapta boğum sayısı, asbau= ana sapta boğum arası uzunluğu, bş= büyüme şekli, phd= pas hastalıklarına dayanıklılık, kd= kışa dayanıklılık, kp= kardeşlenme potansiyeli.

According to the results of the correlation analysis, there were some remarkable relationships between tillering capacity, which is important for pasture establishment and some other characteristics (Table 5). While there are significant ($p<0.01$) and positive correlations between tillering capacity and number of nodes (0.537**), tillering capacity and winter resistance (0.876**), there is a significant ($p<0.05$) and negative correlation between tillering capacity and flag leaf width (-0.401*). Some correlations between winter resistance and some other properties are also notable. There were significant ($p<0.01$)

and positive correlations between winter resistance and number of nodes (0.496**), winter resistance and growth pattern (0.477**).

As a result of the observations and measurements, some single plants were selected from populations for use in variety development studies. These plant were subjected to a ploidy analysis and they all were found tetraploid (Table 6).

Table 5. Correlation Coefficients-r (n=32).
Çizelge 5. Korelasyon katsayıları-r (n=32).

Character Karakter	msl asu	mst ask	fll byb	flw bye	il asbau	nn asbs	gp bş	wr kd	rr phd	tc kp
msl	-	0.667**	0.797**	0.436*	0.521**	0.533**	0.088	0.241	-0.179	0.323
mst			0.619**	0.595**	0.429*	0.155	0.167	0.192	-0.115	0.183
fll				0.523**	0.375*	0.404*	0.040	0.260	-0.213	0.216
flw					0.411*	-0.148	-0.181	-0.438*	-0.240	-0.401*
il						-0.332	-0.345	-0.177	-0.164	-0.081
nn							0.414*	0.496**	0.012	0.537**
gp								0.477**	-0.048	0.396*
wr									0.124	0.876**
rr										0.293
tc										-

*= p≤0.05, **=p≤0.01

Table 6. Ploidy analysis results.
Çizelge 6. Ploidi analizi sonuçları.

Population-single plant no Populasyon-tek bitki numarası	DNA content (pg) DNA içeriği (pg)	Ploidy level Ploidi düzeyi
105-3	9.19	tetraploid
105-7	8.99	tetraploid
102-18	8.64	tetraploid
104-1	8.82	tetraploid
104-3	9.00	tetraploid
104-15	8.66	tetraploid
102-9	9.03	tetraploid
102-13	9.13	tetraploid
101-5	8.94	tetraploid
101-8	9.08	tetraploid
102-11	8.95	tetraploid
102-19	8.84	tetraploid
104-5	8.75	tetraploid
105-2	8.86	tetraploid
105-3	8.90	tetraploid
105-19	8.90	tetraploid
106-1	9.09	tetraploid
106-4	9.07	tetraploid
107-2	9.00	tetraploid
18-20	9.15	tetraploid
19-3	8.88	tetraploid
20-7	8.90	tetraploid
20-4	9.15	tetraploid
20-18	9.18	tetraploid
21-16	9.00	tetraploid
24-8	8.80	tetraploid
24-20	9.10	tetraploid
25-11	8.88	tetraploid
26-4	9.16	tetraploid
27-20	8.90	tetraploid
37-1	9.19	tetraploid
38-20	8.80	tetraploid

CONCLUSION

In this collection and characterization study, when the mean and standard error values in the populations are examined, it appears that there is sufficient variation for the breeding studies. In addition, according to the results of the correlation analysis, some significant relationships were identified in terms of tillering capacity and winter resistance. Positive correlations between tillering capacity and number of nodes (0.537**), tillering capacity and winter resistance (0.876**) and negative correlation between tillering capacity and flag leaf width (-0.401*) were statistically significant. Positive correlations between winter resistance and number of nodes (0.496**), winter resistance and growth pattern (0.477**) were also notable.

The material and information obtained from the study have been used in variety development studies of pasture and forage type cocksfoot (*Dactylis glomerata* L.) in Transitional Zone Agricultural Research Institute.

REFERENCES

Alan, N. 1986. Plant Genetical Sources Hand Book. Aegean Reg. Agr. Res. Ins. Publications. Number 70. Izmir.

Alizadeh, M. A., and A. A. Jafari. 2011. Effect of cold temperature and growth degree days (GDD) on morphological and phenological development and quality characteristics of some ecotypes of cocksfoot (*Dactylis glomerata*). Middle-East Journal of Scientific Research 7 (4): 561-566.

Anonymous. 2016. Technical Instruction for Agricultural Values. Turkish Republic Ministry of Food, Agriculture and Livestock. Variety Registration and Seed Certification Center. http://www.tarim.gov.tr/BUGEM/TTSM/Menu/49 (15/03/2017).

Demiroglu, G., H. Okkaoglu, and R. Avcıoglu. 2008. Correlation and path analysis of yield and some yield related traits of orchardgrass (*Dactylis glomerata* L.). Journal of Agricultural Sciences 1 (2): 49-53.

Hatipoglu, R., C. U. Hesemann, and A. Gland. 1994. Cytological researches on thatching grass (*Hyparrhenia hirta* L.) natural plants of Cukurova Region. E.U. Agricultural Faculty.

Kackar, R. N., and D. A. Harville. 1984. Approximations for standard errors of estimators of fixed and random effects in mixed linear models. Journal of the American Statistical Association 79: 853-862.

Manga, I., Z. Acar, and I. Ayan. 2002. Grass Herbage Crops. Ondokuz Mayıs University, Agricultural Faculty, Text lesson, Number 6, Samsun, p. 286.

Oral, N., and E. Acıkgoz. 2002. Seed Mixtures for Turfgrass Fields. Chamber of Mechanical Engineers Publications. Publication No: 1. Bursa.

Pearson, K. 1920. Notes on the history of correlation. Biometrika 13 (1): 25-45.

Tokluoglu, M. 1979. Some important morphological, biological and agricultural characteristics of some meadow crops. Ankara Univ. Agric. College Pub. No: 728, Research No: 421, Ankara.

Tosun, F. 1973. Breeding of perennial forage crops ryegrass. Atatürk Univ. Pub. No: 21, Agric. College No: 108, Translation No: 10. Ankara.

Wang, Y., C. A. Bigelow, and Y. Jiangi. 2009. Ploidy level and DNA content of perennial ryegrass germplasm as determined by flow cytometry. Hort. Sci. 44 (7): 2049-2052.