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Variation in Some Morphological and Agronomic Characters of Lesser Burnet (*Sanguisorba minor* Scop.)

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Abstract : This work was conducted with two lesser burnet types to determine the amount of variation in some characters. Lesser burnet types were grown in Ankara in the spring of 1996. Plants in the field were observed for a number of morphological and agronomic characteristics in 1997. Bünyan 80 cultivar had superiority for stem number, inflorescence length, 1000 fruit weight, dry yield per plant, leaf ratio, germination at 0.05 probabilty level. A wide range of variation was detected among the plants. Values obtained by rating coefficients of variation for each type made it clear that the variation in native population material was wider for most of the characteristics observed. The upper limits of variation in the material collected from Ankara rangelands were also higher than those of Bünyan 80 cultivar. Data showed that native genotype could be used in lesser burnet breeding studies for agricultural purposes.

Key Words: *Sanguisorba minor*, variation, plant characteristics

Küçük Çayır Düğmesinde (*Sanguisorba minor* Scop.) Bazı Morfolojik ve Tarımsal Karakterlerin Değişimi

Özet : Bu çalışma iki farklı küçük çayır düğmesininde bazı özelliklerdeki varyasyonu belirlemek amacı ile yapılmıştır. Çalışma sonuçlarına göre doğal materyal bitkilerindeki varyasyon daha yüksek bulunmuştur. İki farklı küçük çayır düğmesi 1996 yılı baharında tarlada yetiştirilmiştir. 1997 yılında bazı mofolojik ve tarımsal karakterler üzerinde gözlemler yapılmıştır. Bünyan 80 çeşidi sap sayısı, kömeç uzunluğu, 1000 meyve ağırlığı, bitki verimi, yaprak oranı ve çimlenme yönünden doğal materyalden önemli seviyede (0.05) üstün değerler vermiştir. Bitkiler arasında geniş bir varyasyon belirlenmiştir. Her iki tip bitkinin varyasyon katsayılarının oranlanması ile elde edilen değerler doğadan toplanan bitkilerde incelenen karakterlerin çoğunda daha yüksek bir varyasyon olduğunu ortaya koymuştur. Ankara ili meralarından toplanan bitkilerdeki varyasyonun üst sınırları, genellikle Bünyan 80 çeşidinden daha yüksek bulunmuştur. Elde edilen veriler doğadan toplanan küçük çayır düğmesi bitkilerinin, bu bitkinin tarımsal amaçlı ıslah çalışmalarında kullanılabileceğini göstermektedir.

Anahtar Kelimeler: *Sanguisorba minor*, değişim, bitkisel özellikler

Introduction

The cultivation and provisioning of adequate food to meet the requirements of an ever increasing world population is a matter of great concern. Grazing lands have a source of feed for wild and domestic animals. But, the proportion of high feeding value plants has been decreasing in the forage composition of rangelands due to overgrazing.

These natural resources in Turkey need improvement and production levels increased. This improvement may solve part of the actual roughage problem of livestock sector in Turkey. Furthermore, increased plant cover will help protect soil from the erosion, thus maintaining soils fertility level. Currently, the composition of the vegetation of common rangelands mainly consists of species with low nutritional quality that makes little contribution to feeding value of herbage.

Although lesser burnet (*Sanguisorba minor* Scop.) is a widely distributed species in Turkey (Cullen 1972), its ratio in the vegetation in grazing lands has been decreasing due to continuous, excessive grazing.

It provides nutritious forage for livestock on some rangelands where, in an effort to improve production, good management is practised. As a prostrate species it achieves a full canopy of foliage that covers the soil most of the season.

Lesser burnet has an important role in protecting soils from water and wind erosion since new shoots from the crown form a tough rosette on soil surface. Its long lasting growing period provides livestock with fresh forage in much of the year on rangelands especially on dry and hot summer months.

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Plant breeding has an important role in the development of varieties that not only produce high yields, but also adapt to the local growing conditions such as climate, soil, etc. The plant breeder should seek additional sources of variability where possible (Gill 1989). One of the major and durable contributions to plant breeding is the variation in nature. Johnson et al (1989) detected sufficient genetic diversity which was present among ecotypes of sweetvetch collected 11 locations to assure adaptation to a wide array of sites and to facilitate improvement through breeding and selection. In this study, variation in morphological and agronomic characteristics in one lesser burnet cultivar and one ecotype population have been studied.

Material and Method

"Bünyan 80" lesser burnet cultivar was one of the plant material studied. This cultivar was developed by Central Field Crops Research Institute of Ankara. It produces abundant forage and seed. It is also suitable for grazing (Kadıoğlu 1978). The seed used in the study was obtained from Gözlü State Farm of Konya. The other plant material "Ankara Ecotype" is a collection from the Middle East Technical University's rangelands in Ahlatlıbel Ankara and obtained from Osman Tosun Gene Bank of Ankara University. Climatic data of experimental area is shown in Table 1. Total annual precipitation in both research years was higher than the long term means. Annual temperature means was almost the same with long term mean. Relative humidity varied with the differences in monthly precipitation in years.

Study was planned as a field experiment and conducted in the experimental fields of Agronomy Department of Agricultural Faculty of Ankara University in 1996 and 1997. Seedlings were grown in the greenhouse and transplanted 50x30 cm apart each other in the forages nursery in early spring of 1996. As the first year's development was slow, no measurements were made on plants during that time. Weed control within and between rows was done to encourage plant to develop a successful establishment.

Five plants from each group were cut at full flowering stage and their leaves and stems were separated to determine forage yield. They were dried in an oven at 70 ^{0}C for 48 hrs and weighted separately so that dry yield and leaf/stem ratio could be determined. When the fruits turned a dark yellow colour, ten plants from each group were randomly selected. Plants were cut after their heights were measured. Main stem diameter, stem number, leaves number on main stem, leaf width and length, leaflet number, inflorescence number on main stem, fruit number per inflorescence and fruit size were measured. Fruit from each plant was weighted. Thousand fruit weight and germination rates were determined as described by Şehirali (1989). The basic measurement of variation is variance. Since, in describing the amount of variation in a population a measure often used is the coefficient of variation (CV), it was calculated as described by Snedecor and Cochran (1967). Data obtained were analaysed as described in Düzgüneş et al. (1983) for comparison of 2 groups using t test.

Results and Discussion

Means, standard deviations and coefficients of variation of the characteristics are given in Table 2. Bünyan 80 cultivar has given higher values ($p<0.05$) than natural material for the number of stems per plant, inflorescence length, 1000 fruit weight, dried hay yield per plant, leaf ratio and germination. Douglas et al (1994) reported that lesser burnet plants from large seeds gave higher mean values for leaf area, shoot length, root length and dry weight than those from medium and small seeds.

Since Bünyan 80 cultivar is a selection of better plants, it shows expected superiority over the Ankara Ecotype material in terms of agronomic traits. Tokluoğlu (1980) found the same amount of variation in these characteristics in his study on lesser burnet.

Lesser burnet is considered as a medium-high plant belonging Rosaceae family. Its stems rise about 60-70 cm high. Leaves are on the long stalks bearing 10-20 sharply-tooted leaflets (Cullen 1972)

The variation for many characters was wider in Ankara ecotype than in Bünyan 80 cultivar (Table 2).

Table 3 shows the coefficients of variations for different characteristics. The Ankara Ecotype plants gave higher CV's than the Bünyan 80 cultivar for 13 out of 15 characteristics studied. It is assumed that plant diversity in nature depends on many factors. The pollination mechanism has great effect on the variation in plants. Allogamous plants show wider variation than autogamous. Breeding aims to decrease variation and obtain homogenous plants.

Coefficients of variation of Bünyan 80 cultivar (CVB) were higher in many characters studied (Figure 1). The degree of variation for plant height, stem number, fruit yield, 1000 fruit weight and germination rate was at least three times more in the natural population material. Cultivated plants produce smaller number of bud, flower, seed and fruit when compared with wild plants.

The variation in fruit number per inflorescence and leaf/stem ratio was higher in the Bünyan 80 cultivar. Coefficients of variation of Ankara Ecotype plants (CVA) for these two characters were 1.42 and 1.45 times higher (Figure2).

Lesser burnet, an important forage and erosion control plant, gave varying values for the morphological and agronomic traits investigated in this study.

Table 1. Climatic data for Ankara (long term and during years experiment conducted)

Months	Long term (1920-1999)			1996			1997		
	Tem. (°C)	Humid. (%)	Precip. (mm)	Tem. (°C)	Humid. (%)	Precip. (mm)	Tem. (°C)	Humid. (%)	Precip. (mm)
January	-0.1	78	40.5	1.8	77	30.1	2.3	76	37.1
February	1.3	74	34.9	4.8	74	38.1	0.7	68	17.2
March	5.4	65	35.6	3.8	79	79.2	3.4	59	15.2
April	11.2	59	40.3	9.3	67	36.2	7.5	67	91.3
May	15.9	57	51.6	17.9	64	83.4	17.4	57	71.4
June	19.8	51	32.6	20.2	54	3.2	20.3	55	122.4
July	23.1	44	13.5	25.2	50	4.4	22.8	50	1.4
August	23.0	42	10.3	23.4	53	22.6	20.9	58	29.5
September	18.4	47	17.4	17.1	61	63.1	16.0	55	0.2
October	12.8	58	24.4	11.6	71	44.5	12.9	67	60.0
November	7.3	70	30.9	4.3	71	8.7	7.3	73	36.9
December	2.3	78	45.6	6.6	82	65.1	3.7	77	65.5
Total			377.6			478.6			548.1
Means	11.7	60.2		12.17	67.1		11.3	63.5	

Table 2. Means (X), standard deviation (S_x) and coefficient of variation (CV) in lesser burnet plants

Plant characteristics	Ankara Ecotype			Bünyan 80			P*
	X	$S_{\bar{x}}$	CV	X	$S_{\bar{x}}$	CV	
Plant height (cm)	63.2	16.11	25.49	70.6	4.22	6.01	0.350
Stem diamater (mm)	4.74	10.94	230.80	4.84	8.96	185.12	0.878
Stem number	22.8	10.62	46.57	41.4	5.27	12.73	0.008
Leaf number	14.8	6.38	43.10	14.6	4.61	31.57	0.956
Leaf length (cm)	16.0	4.30	26.87	17.0	2.99	17.50	0.657
Leaflet number	14.4	5.94	41.25	16.4	2.70	16.46	0.513
Inflorescence number	11.6	5.98	51.55	12.2	4.21	34.51	0.859
Fruit number per infloresce.	31.8	4.44	13.54	31.4	6.07	19.33	0.908
Seed yield per plant (g)	23.4	12.44	53.16	32.4	5.77	17.81	0.180
Inflorescence diamater (mm)	8.82	1.20	13.64	10.4	0.95	9.08	0.270
Inflorescence length (mm)	13.4	0.18	13.66	16.2	0.14	8.63	0.028
1000 fruit weight (g)	5.63	1.51	26.80	9.18	0.65	7.08	0.001
Dry yield per plant (g)	66.3	31.70	47.95	93.3	18.15	19.44	0.035
Leaf ratio (%)	45.7	1.13	2.47	54.0	1.94	3.59	0.003
Germination (%)	75.5	14.21	18.82	92.1	4.01	4.35	0.037

- Probability level results according to "t" test.

Table 3. Range of variation for some characteristics of lesser burnet plants

Plant characteristics	Ankara Ecotype Min – Max*		Bünyan 80 Min – Max
Plant height (cm)	49.0 – 88.0	>	66.0 – 77.0
Stem diameter (mm)	3.2 – 6.2	>	3.9 – 5.8
Stem number	12 – 40	<	36 – 48
Leaf number	7 – 24	>	9 – 21
Leaf length (cm)	11.0 – 22.0	>	14.0 – 21.0
Leaflet number	9 – 24	>	14 – 21
Inflorescence number	7 – 21	>	8 – 19
Fruit number per inflorescence	27 – 39	>	26 – 38
Seed yield per plant (g)	12.0 – 43.0	>	30.0 – 39.0
Inflorescence diameter (mm)	8.3 – 9.5	<	9.1 – 11.5
Inflorescence length (mm)	12.1 – 15.4	<	14.4 – 18.0
1000 fruit weight (g)	3.6 – 7.7	<	8.2 – 9.9
Dry yield per plant (g)	59 – 74	<	84 – 112
Leaf ratio (%)	44.4 – 46.4	<	51.8 – 55.3
Germination (%)	57.5 – 93.75	<	87.3 – 97.3

- (<) and (>) signs show the upper limits of the characters studied

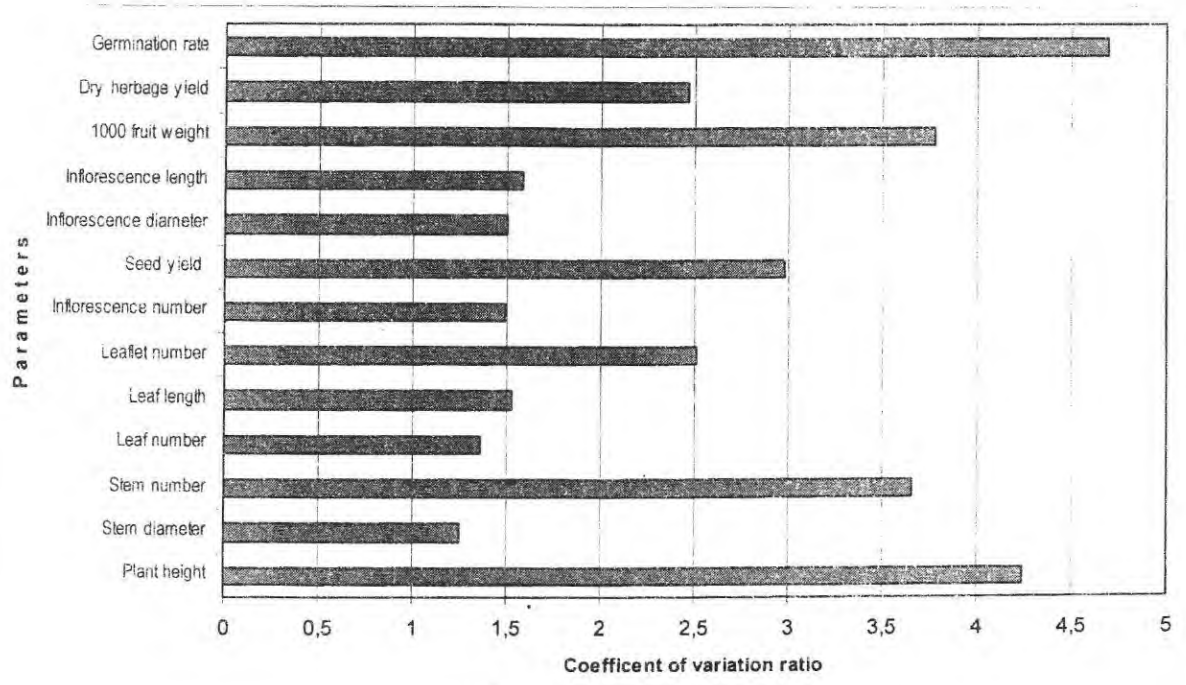

Figure 1. Coefficient of variation ratios for lesser burnet cultivars (CVA / CVB)

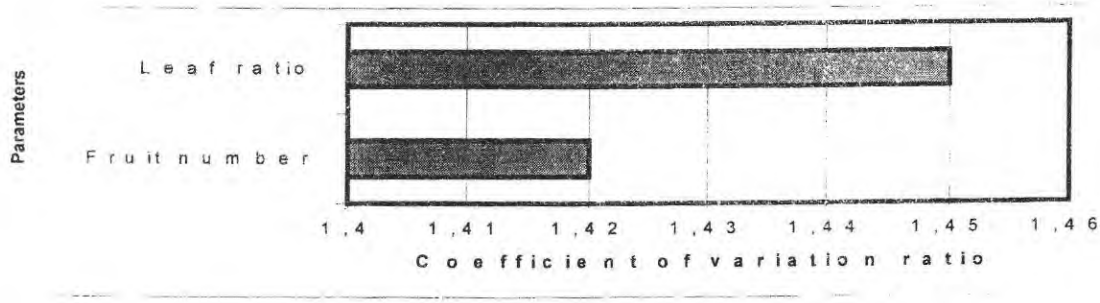

Figure 2. Coefficient of variation ratios for lesser burnet cultivars (CVA / CVB)

The lower and upper limits of variation in Ankara Ecotype plants were very large. Allogamy increases the variation in plant species, especially in quantitative measures (Hayes and Immer 1942). The aim in plant breeding is to select superior plants and propagate them keeping their desired traits (Şehirali and Özgen 1988).

Variation is one of three major elements of plant breeding (Kün 1985). It could be spontaneous or induced. Variation in natural plant population has some advantages over induced variation. It is richer, durable, continuous and easy to use.

The results in this study showed that because of the wide variation in Ankara Ecotype lesser burnet plants, it should be considered a suitable source for burnet breeding studies.

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