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DETERMINATION OF GENETIC VARIABILITY OF EASTERN AND SOUTHEASTERN ANATOLIA REGION TOBACCOS

Omer Caliskan[1], Dursun Kurt[1], Ahmet Kinay[2], Necdet Camas[1], Kudret Kevseroglu[3]

[1]Ondokuz Mayıs University, Vocational High School of Bafra, Samsun, Turkey
[2]Gaziosmanpaşa University, Faculty of Agriculture, Department of Field Crops, Tokat, Turkey
[3]Ondokuz Mayis University, Faculty of Agriculture, Department of Field Crops, Samsun, Turkey

Corresponding author: ocaliskan@omu.edu.tr

Abstract
Tobacco establishing various ecotypes in different ecological zones is one of the crop plants having high genetic variability. In previous years, tobacco ecotypes were conserved by tobacco farming controlled governmentally. But now tobacco sector is privatized. As a result of privatization, companies in tobacco sector have adopted a few ecotypes based on tobacco farming. This phenomenon has increased the risk of extinction for the present genetic variability and now some cultivars are nearly extinct. In this study, conducted to prevent genetic resource erosion, different tobacco ecotypes were determined by visiting the tobacco fields in Eastern and Southeastern Anatolia Region. Some morphological, technique and yield characters of the cultivars were compared by farming them in field via seed. 12 characters of the cultivars were tabulated. Seeds of cultivars, characters of which were determined were delivered to Seed Gene Bank of Turkey.

Keywords: Ecotypes, genetic variation, *Nicotiana tabaccum* L.

Introduction

Tobacco is a different crop plant when compared to the others as the alkaloid nicotine is synthesized in its root and it is also an international legal tips plant. Despite of its all harmful effects on health, it has been used for the same purpose since the first person from Mayan tribe in Yucatan Peninsula. Tobacco plant having high adaptation ability has established ecotypes, suitable for the region where farmed. There are many of tobacco ecotypes in worldwide as it can be farmed in a broad area from 56° N to 38° S latitudes (Esendal, 1986). Turkey has production areas where oriental tobaccos have been farmed successfully for 400 years and experienced producers. Oriental tobacco lines and cultivars, adapted to different ecological conditions have good reputation in worldwide and are indispensable parts of the most appreciated tobacco blends. According to world tobacco production statistics, Turkey is first in oriental tobacco production in country base (FAO, 2015). Yılmaz (1990) separated tobacco production areas of Turkey in 4 regions. The regions are Aegean (Gavurkaya, Akhisar, Ligda, Muğla origins), Black Sea (Trabzon, Maden, Evkaf, Canik, Bafra, Alaçam, Sinop, Gümüşhacıköy, Taşova, Tokat, Erbaa, Niksar origins), Marmara (Düzce, Hendek, İzmit, Bursa, Agonya, Gönen, Yenice, Edirne origins), Eastern and Southeastern Regions of Anatolia (Malatya, Adıyaman, İskenderun, Yayladağ, Bitlis, Silvan, Muş, Şemdinli origins). He mentioned the differences in some morphological and quality characters such as dimension, shape, stem type, tissue, color, rigidity, odor, chemical content among these tobaccos. For example, leaf number per plant was reported to be 17-100 depending on cultivars, ecological conditions and the adopted cultural applications (İncekara, 1979; Emiroğlu et al. 1987; Uz, 1988; Yazan, 1989; Otan and Apti 1989). According to Peksüslü (1998) the oriental tobacco cultivar Bitlis 52 produced the lowest leaf number per plant, but the highest levels for the parameter were observed in the cultivars Agonya 6-1/A, Bafra 6391, Karabağlar 6265 and Düzce Özbaş 190/5. Otan and Apti (1989) reported that Eastern and Southeastern part of Anatolia are the region having the highest variability and ecotypes for oriental tobacco. There were many of indigenous tobaccos in the region as tobacco had been farmed in

many fields of the region, different to each other both ecologically and geographically. Broad leaf webby butt and less webby butt types as well as small leaf webby butt types could be encountered in the region and they had been farmed in their own populations. These researchers indicated the presence of Yayladağ, Malatya, Adıyaman, İskenderun, Diyarbakır, Siirt, Mardin, Muş, Bitlis and Şemdinli populations. The mentioned populations were different from those of Aegean, Marmara and Black Sea regions in terms of their physical and blend characters. "Tombeki" and "Hasankeyf" tobaccos of *Nicotiana rustica* were also present in the region. Ketenci (1985) reported that tobacco was farmed by using the unaccredited seeds and tobaccos having different appearance from different origins were farmed in the same field in Malatya and Adıyaman-Çelikhan 676, a certificated breeding cultivar for the region was degenerated over time and the cultivar could satisfy neither producer nor management in that its yield and quality. Virginia tobacco, substituted for eastern tobaccos, was tried to farm in Urfa surrounding not to cause the unemployment of farmers from eastern regions, farming tobacco for many years. Results indicated that it was possible to farm Virginia tobacco in this region, but not possible to reach the same quality of that, farmed in its own ecology. Researcher concluded that appropriate farming applications as trashing and using of high quality seed were key factors to increase quality of our eastern tobaccos. On the other hand, it is possible to use thick veined eastern tobaccos in blends at the rate of 10% by paying more attention the farming applications. Tobacco fields of the region constituting significant rate of Turkish tobacco production in total are generally mountainous terrains with high altitude. Tobaccos of region have generally stronger flavor and amber in color. It is true that the first tobaccos introducing to Anatolia were sessile but webby butt types were also present (Yılmaz, 1998). Each tobacco region in Turkey where tobacco was either farmed in the past or is being farmed presently has many of ecotypes. Ecotypes are genetic materials which are not possible nearly to find in other ecologies than theirs. For that reason, they are important for both farming and breeding. In this study, it was aimed to determine the biodiversity of Eastern and Southeastern Anatolia region and to take this biodiversity under preservation by re-identifying the present genetic variation. Thus, it would be possible to determine the tobacco genetic diversity of region and to establish data base for future breeding studies.

Material and methods

Plant Material

Production centers of tobacco in our country have been known from past to present very well and based on the knowledge, we determined the provinces and their districts where research trips were conducted. In Eastern and Southeastern Anatolia Region, a total of 57 samples were taken as shown in Table 1. Geographical info on the sampling sites is shown in Table 2.

Table 1. The sampled provinces and their districts from Eastern and Southeastern Anatolia Region

Province	District
Adıyaman	Central district, Kahta, Savsat, Besni, Çelikhan
Batman	Central district, Hasankeyf, Kozluk, Sason
Bitlis	Central district, Güroymak, Hizan, Mutki
Diyarbakır	Central district, Hazro, Kulp, Lice, Silvan
Gaziantep	Şahinbey, Şehitkamil, Araban, Islahiye, Karkamış, Nizip, Nurdağ, Oğuzeli, Yavuzeli
Hakkari	Central district, Şemdinli
Hatay	Central district, İskenderun, Yayladağ, Altınözü
Malatya	Doğanşehir
Mardin	Central district, Mazıdağı, Samur
Muş	Central district, Bulanık, Hasköy

Table 2. Geographical info on the sampling sites from Eastern and Southeastern Anatolia Region

Code	District	Locality	Altitude/Latitude/ Longitude (A/L/L)	*Code*	District	Locality	A/L/L)
D1	Yayladağ	Sebenoba	370-360326-360052	*D37*	Hatay	Altınözü	*
D2	Yayladağ	Sebanoba	369-360325-360053	*D38*	Muş	Merkez	*
D3-4	Yayladağ	Karaköse	463-360107-360204	*D39*	Adıyaman	Çelikhan	*
D5	Yayladağ	Gözlüce	340-360036-355947	*D40*	Muş	Merkez	*
D6-7	Yayladağ	Gözlüce	326-360036-355947	*D41*	Muş	Merkez	*
D8	Samandağ	Meydan	11-360115-355854	*D42*	Hatay	Altınözü	*
D9	Hassa	Merkez	378-364639-363142	*D43*	Batman	Merkez	*
D10-11	Hassa	Yolluklar	694-664712-362716	*D44*	Batman	Merkez	*
D12-13-14	Adıyaman	Alibeyköy	645-374450-382836	*D45*	Batman	Merkez	*
D15-16-17	Kömür	MYÖz. Mh.	747-375206-382638	*D46*	Batman	Merkez	*
D18	Adıyaman	Doğanlı	1272-375942-381334	*D47*	Batman	Merkez	*
D19-20	Doğanşehir	Kurucuova	1479-375847-380619	*D48*	Batman	Merkez	*
D21-22	Hazro	Ormankaya	1024-381750-404620	*D49*	Batman	Merkez	*
D23	Hazro	Ormankaya	1008-381754-404623	*D50*	Batman	Merkez	*
D24	Hazro	Ormankaya	1005-381753-404623	*D51*	Batman	Merkez	*
D25	Diyarbakır	Silvan	*	*D52*	Batman	Merkez	*
D26-27	Batman	Bıçaklı köyü	586-375817-410832	*D53*	Muş	Merkez	*
D28	Kızıltepe	Kahraman	582-371641-403821	*D54*	Malatya	Kurucuova	*
D29-30-31	Muş	Kızılağaç	1315-384739-411932	*D55*	Malatya	Kurucuova	*
D32	Muş	Suvaran	1305-384638-122437	*D56*	Gaziantep	Hasankeyf	*
D33	Bitlis	Bölükyazı	1583-381943-421034	*D57*	Hakkari	Şemdinli	*
D35	Muş	Merkez	*	*D58*	Hakkari	Çukurca	*
D36	Kurucuova	Sürgü	*				

*For these populations, seeds were not collected in field but supplied by farmers not sowing but storing them for many years

Methods

Material Collecting: Field trips were made to Tobacco production areas in Eastern and Southeastern Anatolia Region in 2013. During the trips, plants were selected at the flowering of 10 % stage, sampling form was filled, inflorescences were boxed with isolation bags and the plants were sealed. Before plants were sealed, plant height (cm), leaf long/width (cm), leaf number per plant and flower color were recorded. The second trip was made in seed formation stage and seeds were collected from the boxed capsules for each plant. The old seeds, not sowed but stored by farmers in localities where tobacco was produced in the past were also provided.

Field Studies: After collected, the seeds for each ecotype, collected from different localities were sowed as two rows, 4 m in length in testing site of Ondokuz Mayis University, High School of Bafra in second year. The tested parameters were plant height (distance between plant crown and inflorescence), leaf number per plant (economically important), leaf length / width (2nd hand), stem diameter (center of stem), angle between leaf and stem, angle for the top leaf, number of flowering day (at least 50% of flowering), leaf yield, invert sugar rate, nicotine rate and quality grade. Quality grade was determined based on mean values from scales, established for organoleptic observations. Mean values of these scales, 1 is the best, are 1-4 for leaf dimensions, 1-6 for color and brightness, 1-5 for leaf thickness, 1-4 leaf grainy, 1-5 for strength and flexibility and 1-5 for odor.

Chemical Analyses: Nicotine rate (%): Nicotine content was determined spectrophotometrically as described by Eğilmez (1988). Invert sugar rate (%): Invert sugar content was determined spectrophotometrically as described by Sekin (1979).

Results and discussion

According to the results of the study on Eastern and Southeastern Anatolia Region tobaccos (Bitlis, Yayladağ and Silvan), the average plant height varied with 29-134.6 cm, leaf number per plant 12-42, leaf width 8.2-21.5 cm, leaf length 18.44.2 cm, number of flowering day 48-74 day, the angle between leaf and stem 35-61° (Peksüslü, 1998). Reducing sugar ratio for Turkish tobaccos was reported as between 2-21% and nicotine 0.4-2.5% by Er et al., 2014. Eastern and Southeastern Anatolia tobaccos were also reported to contain 3-5% nicotine (Şahin and Taşlıgil, 2013).

Measurements and Observations for Harvest Period: The lowest and highest values of measurements and observations for harvest period on the basis of province are shown in Table 3.

Table 3. The lowest and highest values of measurements and observations for harvest period on the basis of province.

Province	Locality number	Plant height (cm)	Leaf number	Leaf width (cm)	Leaf length (cm)	Flower color
Adıyaman	8	49.1-103	27-39	11.7-19.5	27-57	white-pink-light pink
Batman	12	126-142	19-27	29.3-31.5	51.7-52.2	pink-light pink
Bitlis	1	41	12	18.3	31.5	red
Diyarbakır	5	47-107	16-20	18-27.5	27-39	white-yellow- pink-light pink
Gaziantep	1	-	-	-	-	-
Hakkari	2	-	-	-	-	-
Hatay	13	66-152	14-41	7.8-50	15.5-70	white-yellow - pink-light pink
Malatya	5	95-105	28-29	19.4-26	45.5-47.5	light pink
Mardin	1	124	18	27	49.5	white- light pink
Muş	9	47-115	15-18	18.5-24.2	32.39-6	white- light pink -pale pink

Plant height (PH, cm): Mean values of tobaccos from eastern region for plant height varied with 19.9 and 104.2 cm. Mean values for this parameter was calculated as 57.8 cm (Table 4). The space values of plant height cumulated was 38-76 cm. It was observed that plant height for 89% of tobaccos from eastern region was under 85.9 cm cumulatively. This region has quite a change of climatic and soil conditions. It is difficult to find similarity/closeness among the cultivars farmed in the broad area where mixed populations are prevalent. This phenomenon affected plant height significantly and as a result the difference between the lowest and highest values for this parameter was found to be bigger than that of other regions (Table 5).

Leaf Number per Plant (NP, number/plant): Mean values for leaf number per plant varied with 12 and 51 among lines (Table 4). Data for the parameter was recorded between 12.1 and 29.6 and the mean was determined as 23. Tipping is the reason why leaf number per plant such fluctuated. 10% of the studied lines produced 34-51 leaves per plant. It is noteworthy to note that short lines produced low leaf per plant but tall ones produced higher values for the parameter. This phenomenon was attributed the abundance of tobacco ecotypes in this region and tipping applied to some lines (Table 5).

Leaf Width (LW, cm): Among lines, leaf width varied with 7.28 and 21.56 cm (Table 4). Generally lines yielded leaves whose widths were between 10.5 and 15.5 cm. Mean value for the parameter was recorded as 13.16 cm. The reason why leaf width values were higher in this region than those of the other ones is development of the leaves, left following tipping. Leaf length and width are characters belonging to given cultivar; as a result, different ecotypes of the region were differed with leaf dimensions as it is expected. Besides, leaf development increased in tipped tobacco, thus leaf length and width also increased in parallel (Table 5). *Leaf length (LL, cm)*: It was observed that leaf length was differed with 13.58 and 47.18 cm (Table 4). Mean values centered between 17 and 32.5 cm cumulatively. Tipping was considered again the reason why eastern tobaccos yielded taller leaves than tobaccos from other regions. It was observed that the leaves, left following tipping continued

to develop (Table 5). *Stem Diameter (SD, mm)*: Mean values for stem diameter of eastern tobaccos varied with 6.76 and 16.61 mm (Table 4). It was observed that stem diameters centered 10.9 and 14.4 mm. Mean value for stem diameter was found to be 11.2 mm. In tipped lines, stem diameter was affected and increased as shown in Table 5. *Angle between Leaf and Stem (AS, ^{0})*: This parameter varied with 31.8 and 77.4° (Table 4). Most of the means were recorded between 43 and 66°. The great variation in the mean values could be attributed to abundance of tobacco cultivars in the region as shown in Table 5. *Angle for the Top Leaf (AL, ^{0})*: Angle for the top leaf of eastern tobaccos varied with 43.2 and 87.8° and mean value for the parameter was recorded as 72.14° (Table 4). Lines yielding angle for the top leaf from 79 to 87° has constituted 50% of total lines studied. Variation in angle for the top leaf was a result of the great cultivar variability in the region (Table 5).

Table 4. Statistical data for Eastern and Southeastern Anatolia Region tobaccos

	Plant height (cm)	Leaf number per plant	Leaf width (cm)	Leaf length (cm)	Stem diameter (mm)	Stem angle (^{0})
Mean	57.8	23.16	13.16	26.38	11.18	53.72
Standard error	2.654	1.131	0.394	1.011	0.321	1.304
Median	57.8	20.6	13.36	26.1	11.272	54.8
Standard deviation	20.043	8.533	2.979	7.633	2.416	9.846
Genotype number	57	57	57	57	57	57
The highest	104.2	51	21.56	47.18	16.61	77.4
The lowest	19.9	12	7.28	13.58	6.76	31.8
	Top angle (^{0})	Number of flowering day (day)	Yield (kg/da)	Invert sugar (%)	Nicotine (%)	Yield (%)
Mean	72.14	53.86	129.59	2.33	2.6	48.405
Standard error	1.788	1.724	5.0129	0.101	0.088	1.054
Median	78.4	51	121.869	2.16	2.685	48.61
Standard deviation	13.499	13.022	37.846	0.766	0.665	7.963
Genotype number	57	57	57	57	57	57
The highest	87.8	102	220.13	4.23	3.69	70.56
The lowest	43.2	46	73.73	1.29	0.74	34.17

Number of Flowering Day (FD): Eastern tobaccos flowered during a period from 46 to 102 days as shown in Table 4. Among the studied lines, one flowered in 92th and 3 lines flowered in 101-102th days. The difference in flowering days of the lines was not surprising when considering the great cultivar variability in this region (Table 5). *Leaf Yield (LY, kg/da)*: Leaf yield for the studied lines varied with 73.73 and 220.13 kg/da (Table 4). 80% of the lines produced leaf per decare from 73 to 147 kg. Mean value for the parameter was recorded as 129.59. It should be noted that leaf yield was found to be higher than the level of 160 kg/da for 11 lines. Higher leaf yields for eastern tobaccos were probably caused by different agricultural practices namely, tipping, fertilization and irrigation (Table 5). *Invert Sugar Rate (IS, %)*: Invert sugar rates varied with 1.29 and 4.23 (Table 4). It should be noted that invert sugar rate in 80% of the studied lines was under 2.92% level (Table 5). *Nicotine Rate (N, %)*: Nicotine content of eastern tobaccos varied with 0.74 and 3.69% and mean value for the parameter was found to be 2.6% (Table 4). 2/3 of the lines examined yielded nicotine in rates of 2.4-3.5%. It can be concluded that fertilization and irrigation, applied to eastern tobaccos, but not the tobaccos from other regions increased nicotine content of these tobaccos (Table 5).
Quality Grade (QG, %): Quality grade of eastern tobaccos varied with 34.17 and 70.56 (Table 4) and was found to be 40-59 averagely (Table 5).

Table 5. Mean values for yield, the morphologic, chemical and some technologic characters of tobacco lines from Eastern and Southeastern Anatolia Region

Code	PH	NP	LW	LL	SD	AS	AL	FC	FD	LY	IS	N	QG
D1	81.60	26.80	18.16	29.36	15.32	57.00	76.20	l.pink	92	199.09	2.14	2.83	36.94
D2	87.40	31.00	12.40	23.84	12.38	59.60	85.40	pink	101	140.78	1.87	2.63	36.94
D3	86.20	32.20	11.58	24.70	11.76	53.80	84.20	l.pink	102	190.37	2.44	2.72	35.83
D4	91.20	31.00	12.60	21.40	12.21	58.00	85.40	l.pink	101	120.82	1.93	3.15	39.72
D5	76.20	25.80	15.10	41.44	13.94	49.60	65.00	white	55	134.48	1.54	3.08	47.22
D6	88.90	26.60	13.84	39.84	13.99	42.80	58.80	white	53	220.14	1.78	2.49	49.17
D7	81.20	20.60	13.48	34.94	12.12	63.60	69.00	l.pink	54	212.71	2.85	2.63	36.94
D8	52.60	17.20	18.82	30.54	13.92	52.20	72.60	l.pink	54	106.37	3.52	2.99	34.17
D9	48.30	16.60	12.92	13.58	10.07	54.80	81.60	l.yel.	46	96.82	2.54	2.69	55.56
D10	33.60	20.20	17.40	24.58	6.76	32.60	83.40	l.yel.	46	99.09	3.21	2.57	45.28
D11	32.80	20.00	17.10	23.54	6.76	32.20	81.20	l.yel.	46	124.50	2.94	2.06	45.28
D12	73.40	26.20	13.78	35.04	13.51	50.40	53.40	l.pink	56	220.10	1.47	1.09	48.61
D13	62.40	24.60	11.90	33.82	12.36	41.20	54.20	l.pink	47	122.92	2.52	2.29	45.28
D14	75.60	27.80	21.56	47.18	16.61	44.80	55.00	l.pink	51	190.68	1.43	0.91	48.61
D15	39.10	24.60	14.28	36.74	13.80	48.00	45.60	l.pink	47	121.87	1.91	1.77	49.72
D16	39.60	20.00	15.34	39.50	13.40	41.80	53.00	white	53	135.53	3.34	1.74	44.72
D17	35.00	16.60	9.92	23.72	9.43	51.60	51.80	l.pink	53	145.90	2.71	1.75	45.28
D18	47.10	21.40	13.36	39.74	14.37	42.00	48.40	l.yel.	51	195.94	1.72	3.36	44.44
D19	53.40	18.20	9.86	30.68	12.24	59.40	49.80	pink	46	107.42	1.77	1.86	49.44
D20	42.20	18.00	12.94	31.08	10.64	45.60	63.20	pink	46	112.35	2.76	2.89	45.28
D21	44.90	13.60	14.94	26.56	8.95	42.80	86.00	l.pink	51	101.85	3.21	2.51	45.28
D22	38.60	15.40	15.66	26.70	11.11	50.40	80.20	l.pink	46	102.99	1.81	2.82	51.94
D23	40.20	16.20	16.74	20.02	11.61	49.60	74.00	l.pink	48	86.26	2.66	3.18	43.61
D24	59.40	15.20	15.46	25.66	8.19	57.20	87.80	l.pink	47	170.20	1.90	1.56	48.61
D25	53.10	14.60	16.74	32.54	11.56	53.40	83.00	l.pink	53	125.92	2.59	2.44	45.28
D26	56.00	17.40	14.84	27.00	10.85	50.60	79.40	l.pink	53	96.54	2.85	2.27	39.17
D27	47.00	16.40	14.74	26.10	9.43	59.40	82.60	l.pink	53	171.77	3.84	2.21	41.94
D28	46.60	15.40	12.20	26.94	8.33	55.00	61.20	l.pink	49	99.09	1.93	2.76	48.61
D29	40.20	14.20	14.02	26.68	11.51	45.60	81.00	l.pink	49	94.95	1.49	2.21	50.28
D30	41.20	15.20	14.53	27.54	10.81	50.40	73.40	l.pink	50	73.73	3.67	2.25	46.67
D31	39.00	12.40	13.64	24.32	11.00	56.60	82.60	l.pink	54	89.99	1.34	2.39	45.83
D32	60.40	15.20	13.34	23.00	9.02	49.60	82.20	l.pink	46	113.99	3.78	2.77	49.44
D33	19.90	12.00	10.80	18.40	7.77	69.60	78.40	pink	46	93.62	4.23	0.74	54.17
D35	65.30	22.40	12.78	25.62	11.27	59.80	72.80	white	54	104.01	1.84	3.69	54.72
D36	51.00	26.00	10.70	31.90	13.13	49.20	48.80	l.pink	46	130.54	1.37	2.75	41.94
D37	71.20	27.00	13.54	22.56	10.30	49.80	79.60	l.pink	56	136.32	1.57	3.24	56.94
D38	74.42	27.80	14.16	32.04	13.37	77.40	51.60	l.pink	54	123.97	1.91	3.46	37.78
D39	48.30	26.80	12.86	35.92	14.23	64.20	43.20	l.pink	55	172.30	1.32	3.38	48.61
D40	63.20	26.80	15.00	28.00	13.48	58.00	81.20	l.pink	56	140.04	1.48	3.32	48.61
D41	85.40	25.60	15.84	31.00	13.39	53.80	75.80	l.yel.	52	140.44	2.33	3.04	58.89
D42	68.50	30.40	14.90	19.80	12.82	59.20	83.80	l.pink	51	99.61	2.33	3.08	55.56
D43	59.20	18.80	17.44	33.24	11.70	58.20	76.70	l.pink	52	130.54	1.60	2.63	45.83
D44	58.50	42.60	10.56	18.34	15.36	66.00	84.20	l.yel.	51	142.16	2.26	2.43	63.61
D45	65.10	36.40	7.28	13.96	7.40	56.00	72.40	l.pink	46	131.08	2.22	2.53	57.5
D46	72.28	51.00	9.78	20.22	13.07	55.40	85.60	white	53	214.82	2.30	2.86	70.56
D47	104.20	43.00	10.46	20.92	10.79	76.80	81.40	pink	47	143.75	1.96	2.42	36.67
D48	83.20	33.00	8.82	17.74	9.66	70.00	84.70	pink	46	101.38	3.63	3.33	48.61
D49	85.10	35.00	9.00	17.40	9.24	55.80	83.80	l.pink	50	103.97	1.87	2.81	64.72
D50	89.80	27.40	10.96	19.50	9.10	60.40	86.20	l.pink	46	113.46	3.77	3.49	48.06
D51	68.00	18.00	14.36	26.66	10.00	56.00	68.40	l.pink	50	118.07	1.29	2.43	48.61
D52	57.80	39.80	11.42	17.74	12.05	64.40	83.00	l.pink	58	106.63	2.89	3.48	67.22
D53	61.60	18.60	9.16	16.32	7.65	56.00	78.40	l.pink	55	138.68	2.16	1.31	40.28
D54	31.30	19.20	7.52	22.62	10.20	66.00	52.40	l.pink	51	89.47	1.74	2.86	55.28
D55	25.60	17.40	9.34	27.71	10.95	62.00	48.80	l.pink	54	92.83	1.81	3.17	51.39
D56	31.40	20.60	11.80	14.08	7.16	31.80	79.40	l.yel.	47	91.16	3.39	2.27	44.44
D57	29.40	15.20	7.68	13.92	6.77	35.40	83.00	l.yel.	47	112.27	2.26	3.55	64.44
D58	34.40	13.00	11.02	19.58	8.20	49.00	77.80	l.pink	48	90.61	2.01	3.09	53.61

*PH; plant height, NP; leaf number per plant, LW; leaf width, LL; leaf length, SD; stem diameter, AS; angle between leaf and stem, AL; angle for the top leaf, FC; flower color, FD; number of flowering day, LY; leaf yield, IS; invert sugar rate, N; nicotine rate, QG; quality grade, l.; light, l.yel.; light yellow

Conclusions

Turkey is one of the most important geographic areas of the world having high plant diversity as it has three different phytogeographic regions (Europe-Siberia, Persian-Turan, Mediterranean) as well as distinctive climatic and soil characters and is a junction of two gene centers (Mediterranean and the Near East). Tobacco is a very adaptive plant which can establish idiocratical ecotypes in response to geographic and climatic conditions of its environment. In the present study, variation limits of tobacco ecotypes from Eastern and Southeastern Anatolian region was revealed in detail and seeds of the examined ecotypes were delivered to Seed Gene Bank of Turkey.

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