

Grain Legumes Genetic Resources Activities in Turkey

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Introduction

It is situated at the intersection of the world's most important gene or origin centre because of both its geographical situation and various ecological conditions. Turkey's flora includes around 10 000 plant taxa and more than 3 000 of them are endemic.

As a centre of origin many important crops, wild relatives, land races and weedy forms of main crops are found in diverse forms. Turkey is also the centre of origin of *Cicer*, *Lens* and *Pisum* and described as micro gene centre for *Lens culinaris*, *Phaseolus vulgaris*, *Vicia faba*, *Lupinus spp.*

According to Harlan (1951) there are 5 micro gene centres in which more than 100 species, including *Lens culinaris*, *Phaseolus vulgaris*, *Vicia faba*, *Lupinus spp.*, have large variability in Turkey (Demir 1990). These centres and the important grain legumes species are shown in the map1.

Map 1. Micro gene centres in Turkey.



Turkey is rich in terms of wild relatives of grain legumes. Five wild species of lentil and twelve annual or perennial wild *Cicer* species occur in Turkey. On the other hand wild and weedy forms of *Pisum* are founded in Turkey (Tan, 1998)

Plant genetic resources activities in Turkey have been conducted by Aegean Agricultural Research Institute (AARI) in Izmir. These activities of Turkey started in 1964. These studies were implemented within the framework of National Plant Genetic Resources/Diversity Research Program (NPGRP) in 1976. Aegean Agricultural Research Institute (AARI) has taken over all responsibility at national level as being the project centre. AARI holds a

National gene bank with its more than 50 000 accessions of several crop and plant species and operates at international standards. The storage facilities exist at Field Crops Central Research Institute which holds 6 000 material containing cereals, food and forage legumes mostly and their wild relatives and some endemic plants and safe-duplicates of some accessions of National collections.

The genetic resources activities are regulated by the “Regulation on Collection, Conservation and Utilization of Plant Genetic Resources” since 1992. All joint programs are conducted on the project basis on agreed condition (Tan, 2000).

***Ex situ* conservation**

Seed materials are stored in controlled conditions in the gene bank at AARI. The national genebank has long and medium term storage facilities for base and active collections and short-term storage facilities for working samples of breeding programs (Tan,1998).Table 1 is shown the storage facilities of National Gene bank.

Table 1. Conservation facilities in cold stores of AARI gene bank.

	Short-term storage	Medium-term storage	Long-term storage
Temperature (°C)	+4	0	-20
Moisture content (%)	6 - 8	6 - 8	6
Container type	LAP	ASCN	ASCN
Viability monitoring	-	5-year intervals	10-year intervals

LAP: aluminium laminated foil bags, ASCN: aluminium sealed can containers

The legume collection of National gene bank and distributions of these collections are given in Table 2 and Table 3 respectively.

Table 2. Food legume collections at AARI national genebank by 2007

Genus/species	No. of accessions
<i>Cicer</i>	2 079
<i>Lens</i>	1 087
<i>Phaseolus</i>	2849
<i>Pisum</i>	120
<i>Vicia faba</i>	373
<i>Vigna sinensis</i>	12
<i>Vigna unguiculata</i>	59
<i>Lupinus</i>	5
Total	6 584

Table 3. Number of accessions distributed in 2002-2007

Year	<i>Cicer</i>	<i>Lens</i>	<i>Pisum</i>	<i>Phaseolus</i>	<i>Vicia faba</i>	Total
2002	142	-	19	115	41	317
2003	-	-	-	28	-	28
2004	92	-	-	41	100	233
2005	-	-	-	15	-	15
2006	10	-	30	41	-	81
2007	-	-	-	-	6	6
Total	244	-	49	240	141	674

Grain Legume Collections

During 2001-2007, 1389 accessions were collected from different sites of Turkey (Table 4). The recent collection missions, in 2005 and 2006 seed and herbarium of *Cicer montbretii*, *Lens nigricans* and *Lens ervoides* were collected in Kozak Plateau. Additionally, In Bozdag seed and herbarium of *Lens nigricans*, *Lens ervoides* and *Lens culinaris* were collected. Some chickpea local populations were collected in South Eastern Region (Diyarbakır, Mardin and Sanlıurfa). The legume land races from remote sites of Northern Aegean region will be collected in October 2007.

Table 4. Number of accessions collected, 2001-2007

Genus/species	No. of accessions
<i>Cicer</i>	289
<i>Lens</i>	472
<i>Phaseolus vulgaris</i>	585
<i>Pisum sativum</i>	12
<i>Vicia faba</i>	31
Total	1389

Multiplication/Regeneration

During 2002-2007, totally 905 accessions were regenerated (Table 5).

Table 5. Number of accessions regenerated in 2002-2007

	<i>Cicer</i>	<i>Lens</i>	<i>Pisum</i>	<i>Phaseolus</i>	<i>Vicia faba</i>	Total
2002	49	-	-	-	16	65
2003	136	-	-	300	29	465
2005	101	44	5	-	2	152
2006	5	14	4	144	2	167
2007	56	-	-	-	-	56
Total	347	58	9	444	858	905

Characterization

In AARI characterization and evaluation studies started on chickpea in 1993. The characterized accessions according to IBPGR description list are given below (Table 6).

Table 6. Number of evaluation and characterization of food legume collections

Genus/species	No. Of accessions
<i>Cicer</i>	1311
<i>Lens</i>	246
<i>Phaseolus</i>	208
<i>Pisum</i>	20
Total	1499

Evaluation for onfarm conservation:

Tan (2002) led an *in situ*, on farm project in Northwestern Transitional Region of Turkey to determine and evaluate and conserve on farm the chickpea, common beans (*Ph. vulgaris* and *Ph. coccineus*) and lentil land races. 96 chickpea, 121 common bean and 65 lentil land races have been evaluated for various agro-morphological characters and for the decision of the possibility of on farm conservation. The ethno-botanical and the socio economic data are also collected.

Evaluation for Ascochyta Blight and cold tolerance:

327 chickpea accessions collected from East Anatolia, Middle Anatolia and South East Anatolia Regions and 8 registered varieties screened for the ascochyta blight disease of chickpea under the artificial epiphytotic conditions in the field and for cold tolerance at Bozdag (1200 m elevation). Nearly all of the accessions were found to be very susceptible to ascochyta blight. Neither accessions nor standards were found to be tolerant to -11.7 °C min temperature (Atikyilmaz, 2000)

Characterization for breeding purposes:

In AARI, genetic resources are used in breeding programs to widen the genetic base. Therefore 100 faba bean accessions obtained from National Faba Bean Collection from Aegean and Marmara Regions were observed for various characters in faba bean breeding program in 2004. The characters observed in the nursery were; seed yield (g/plot), seed yield per plant (g), one hundred seed weight (g), plant height (cm), first pod height (cm), branches per plant, pods per plant, seeds per plant and seeds per pod. Wide variation was found in the collection in terms of all characters (Table 7).

Table 7. The means and intervals of the characters observed in National Faba Bean Collection

Characters	Intervals	Mean
Seed yield (g/plot)	86-795	529
Single plant yield (g)	5.5-78.5	34.7
100 seed weight (g)	46.4-81.4	66
Plant height (cm)	53.2-160.5	119
First pod height (cm)	7-32.2	19.1
Branches/plant	1-6.3	3.7
Pods/plant	1.2-99	10.7
Seed/plant	3.5-45	16.8

In common bean breeding program, 85 common bean accessions from Marmara, Aegean Regions and Central Anatolia were also observed. One accession was *Phaseolus coccineus*, the others were *Phaseolus vulgaris*. One hundred seed weight changed between 23-114 g, 68 accessions were found as type II and type III and 17 accessions were mixed (type I-II). In breeding program 17 accessions will be used further.

Characterization studies on chickpea, lentil, beans and pea have been also conducted in other Institutes and organizations in Turkey recent years. Some of them are presented below. In these studies principle component analysis was generally used to distinguish the material.

Chickpea

1. 46 chickpea landraces from Diyarbakir were characterized in 2000 (Bicer and Anlarsal 2005). As a seed shape, ram head form, pea form and own head form were determined. Also, white, black, beige, yellow, dark yellow, and light brown colored seed material were found. Four different types of seed coat property; wrinkle hairy, wrinkle unhairy, smooth hairy, smooth unhairy seed were found. There were 23 semi-spread, 12 semi-erect and 11 spread types.

2. (Mart 2003) characterized 170 local chickpeas from different provinces (Adana, Hatay, Osmaniye, Maras, Mersin and Karaman) in generally Cukurova Region. Primary brances and the flowering duration were found as the main characters for prin 1 while flowering duration and pod number per plant for prin 2 and leaflet length and pod size for prin 3.

3. Karakoy et al (2007) characterized 91 chickpea landraces (60 from Adana, Hatay, Osmaniye, Maras, Mersin and Karaman and 31 from Diyarbakir) in 2005-2006.

Lentil :

Aydogan et al (2003), characterized 334 green lentil populations collected from 12 provinces (Yozgat, Corum, Cankiri, Kirsehir, Kirikkale, Sivas, Tokat, Amasya, Nevsehir, Kayseri, Nigde ve Ankara) in Central Anatolia and Northern Transitional zones were characterized for 25 traits. Among the characters observed, variation was determined with 14 characters while no variation was observed with 11 characters. All the samples had green testa and yellow cotyledons.

Karakoy et al (2007) characterized 39 lentil landraces collected from Southeastern Anatolian Region and 7 cultivars in 2005-2006 growing season. The characters examined are seedling pigmentation, leaf pubescence, tendril length, days to flowering, flowering duration, days to maturity, plant height, biological yield, weight of pods/plant, number of pods/plant, number of seeds/plant, weight of seeds/plant, diameter of seed, 100 seed weight and protein content.

Beans :

1. Sozen (2007) characterized 292 bean landraces from 279 locations of 74 villages from Artvin province in Black Sea Region. 88 dry bean sub samples were dwarf, 29 sub samples were semi dwarf and 175 sub samples were climbing form. 145 sub samples were white, whereas 147 sub samples had other colors. Cluster analysis revealed that white and colored seed varieties could be classified into 23 and 26 groups, respectively. All the obtained data showed that this material has a rich variation and could be used for both new cultivars developing as dry and fresh consumption and different breeding purposes.

2. Madakbas (2006) studied to obtain new cultivar from local common bean in Carsamba plain in Black Sea Region during the years 2002-2005. Characterization was made according to UPOV criteria during preliminary yield experiments. Discriminant analysis was used to show the distance between obtained data and the lines and cluster analyze was used to clarify the expected numbers of groups.

3. Peksen et al all (2006) characterized ten faba bean populations collected from some districts and villages of Samsun, Amasya, Sinop ve Tokat provinces between 2003 and 2005 under Samsun ecological conditions. Days to first flower onset, the length of flowering period, plant height, the number of branches and pods per plant, pod length, width and

thickness, and green pod yield per plant were examined. There was no significant difference among faba bean population/cultivars for green pod yield per plant.

Pea :

Karayel (2006) characterized 40 local pea (*Pisum sativum*) land races (obtained from National Gene Bank and provinces in Samsun) and 6 commercial cultivars were characterized in 2004-2005. Frequency distributions of some characters were determined for the populations. Description of UPOV and CPVO was used for characterization. The observed components on local genotypes showed wide variation. In this case, they can be used for improvement of food and feed cultivars by breeders.

Utilization

There are eight registered varieties derived from local populations (landraces) in grain legumes in Turkey (Table 7).

Table 7 . Registered varieties from local population and the locations in Grain Legumes

Crop	Registered Name
Cowpea	1. Akkiz 86 (Aegean Region) 2. Karagoz 86 (Aegean Region)
Lentil	1. Kislik pul 11 (Osmaniye) 2. Kislik yesil 21 (Kirsehir) 3. Kislik yesil 31 (Kirsehir) 4. Kislik Kirmizi 51 (Gaziantep) 5. Sultan I (Kocas-Aksaray) 6. Emre 20 (Vezirkopru-Samsun) 7. Sakar (South Eastern Region)
Common Bean	1. Eskisehir 855 J (Bursa) 2. Gungor (Kahramanmaras)
Faba Bean	1. Eresen87 (Aegean Region)

Ongoing Studies

Besides legume genetic resources program there are various projects conducted on legumes breeding. On these projects the legume germplasm are also used.

A yield trail including 15 lines selected from National Faba Bean Collections from Aegean and Marmara Regions will be carried out in 2008.

There is still a promising line selected from Kastamonu (Black Sea Region) local populations in common bean registration trial.

There are two projects on improving new variety from local common bean populations are being conducted in two Institutions (Kahramanmaras Agricultural Research Institute and Erzincan Horticultural Research Institute). Cukurova Agricultural Institute is also works on improving a chickpea variety from local populations.

Future Studies

1. It is planned to characterize food legume collection in the National Gene Bank in morphological and molecular levels continuously. (Aegean Agricultural Research Institute)
2. Improving and registration local common bean landraces grown commonly in Turkey (All Institutes in Turkey)
3. Characterization of Phenolics Content, Antioxidant Activity and Protein Functionality of Some Chickpea Cultivars Grown in Turkey and Determination of Genetic Diversity in National Chickpea (*Cicer arietinum* L.) Collections. (Collaboration with Izmir Institute of Technology)
4. Determination of the Races of Bean common mosaic potyvirus (BCMV) and Bean common mosaic necrosis potyvirus (BCMNV) Causing Infection in the Dry Bean Areas and Investigation of Resistance Levels of Some Local Dry Bean Cultivars Against BCMV and BCMNV Using Qualitative, Quantitative and Molecular Methods in Samsun Province of Turkey (Black Sea Region Agricultural Research Institute)

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