

Cultivated local *Lathyrus* varieties in Turkey and their some agronomical traits

Basaran U., Acar Z., Onal Asci O., Mut H., Tongel O.

in

Porqueddu C. (ed.), Ríos S. (ed.).
The contributions of grasslands to the conservation of Mediterranean biodiversity

Zaragoza : CIHEAM / CIBIO / FAO / SEEP

Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 92

2010

pages 129-133

Article available on line / Article disponible en ligne à l'adresse :

<http://om.ciheam.org/article.php?IDPDF=801230>

To cite this article / Pour citer cet article

Basaran U., Acar Z., Onal Asci O., Mut H., Tongel O. **Cultivated local *Lathyrus* varieties in Turkey and their some agronomical traits.** In : Porqueddu C. (ed.), Ríos S. (ed.). *The contributions of grasslands to the conservation of Mediterranean biodiversity*. Zaragoza : CIHEAM / CIBIO / FAO / SEEP, 2010. p. 129-133 (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 92)



<http://www.ciheam.org/>
<http://om.ciheam.org/>

Cultivated local *Lathyrus* varieties in Turkey and their some agronomical traits

U. Basaran*, Z. Acar*, O. Onal Asci**, H. Mut* and O. Tongel***

*Ondokuz Mayıs University Agriculture Faculty, Agronomy Department, Samsun (Turkey)

**Ordu University, Agriculture Faculty, Agronomy Department, Ordu (Turkey)

***Black Sea Agricultural Research Institute, Samsun (Turkey)

e-mail: ugurb@omu.edu.tr

Abstract. This study includes the general status of *Lathyrus* cultivation and some agronomic features of *Lathyrus* species cultivated in Turkey. Although *Lathyrus* has been widely cultivated in Anatolia for thousand years, there are only one released *Lathyrus* species. All farmers have used local variety seeds. Studies on agronomic features and growing conditions of these varieties are insufficient. So, expeditions were organized to collect cultivated *Lathyrus* species and ecotypes from 12 sites located in Anatolia. Almost all plants were *L. sativus* except one, which belonged to *L. clymenum*. All the accessions were collected from the farmers. Their utilization types, runner situation, and local names were found out. As agronomical traits, 1000 seed weight and crude protein contents of these accessions were determined as well.

Keywords. *Lathyrus* – Grass pea – Turkey – Local variety – Crude protein.

Quelques caractères agronomiques des variétés de *Lathyrus* localement cultivées en Turquie

Résumé. Cette étude présente la situation générale de la culture de *Lathyrus* et certains caractères agronomiques des espèces de *Lathyrus* cultivées en Turquie. Bien que *Lathyrus* ait été largement cultivé en Anatolie pendant des milliers d'années, il n'existe qu'une espèce de *Lathyrus* commercialisée. Tous les agriculteurs ont utilisé des semences de variétés locales. Les études des caractères agronomiques et des conditions de culture de ces variétés sont également insuffisantes. Ainsi des expéditions ont été organisées pour collecter des espèces de *Lathyrus* cultivées et des écotypes de 12 sites d'Anatolie. Pratiquement toutes les plantes étaient des *L. sativus* excepté une, appartenant à *L. clymenum*. Toutes les accessions ont été collectées chez les agriculteurs. Leurs types d'utilisation, situation actuelle, et noms locaux ont été rapportés. Comme caractères agronomiques, le poids de 1000 semences et la teneur en protéine brute de ces accessions ont également été déterminés.

Mots-clés. *Lathyrus* – Pois – Turquie – Variété locale – Protéine brute.

I – Introduction

The genus *Lathyrus* L. of the family Leguminosae includes 160 annual and perennial species (Plitmann *et al.*, 1995). Only one species – *Lathyrus sativus* – is widely cultivated as a food crop over the world, while other species such as *L. cicera*, *L. clymenum*, *L. ochrus*, *L. tinginatus*, *L. latifolius* and *L. sylvestris* are cultivated as grain, forage or food (Campbell, 1997).

Lathyrus sativus is an annual leguminous crop cultivated throughout the arid regions of the Near East, North Africa, West Asia, and Indian subcontinent, China, and grown on a small scale in South America, Canada and Middle East for animal or human consumption (Yan *et al.*, 2006). Common names include grass pea, chickling pea or Indian vetch in the UK and North America; almorta, muela, tito and guijo in Spain; gesette in France; pisello bretonne in Italy; murdumuk in Turkey.

L. sativus performs well under adverse agricultural conditions, and its many cultivars possess different attributes including the ability to resist both drought and flooding, high climatic adaptability to grow in cool climates, different soil types and at high altitudes (Campbell, 1997).

One of the major drawbacks of grass pea is the fact that the seeds contain a major anti-nutritional compound β -N-oxalylamino-L-alanine (BOAA) (also known as β -N-oxalyl-L- α , β -diaminopropionic acid or ODAP) (Wang *et al.*, 2000). Following prolonged or excessive consumption of *L. sativus*, the neurotoxin causes a drastic paralytic disease known as lathyrism or neurolathyrism, manifesting as paralysis of the leg muscles, muscular rigidity and weakness (Mehta *et al.*, 1994). Recent studies have found that genotype is the main determinant of ODAP concentration, with little if any effect from environment (Lambien *et al.*, 1993). Scientific papers have not included certain lathyrism disease in man or animal and any information about banning of *Lathyrus* in Turkey (Acar and Basaran).

Davis (1970), reported the existence of 58 *Lathyrus* species in Turkey, being *L. sativus* widely cultivated. Other cultivated species are *L. ochrus*, and *L. cicera* (Genc and Sahin, 2001).

Information about growing conditions, geographical distribution and uses and also agronomical features of cultivated *Lathyrus* in Turkey are not satisfactory. For this aim, expeditions were carried out to collect cultivated *Lathyrus* genotypes and to determine their uses and geographical distribution in Turkey in autumn 2007. At the end of these expeditions, 45 *Lathyrus* accessions belonging to *L. sativus* and *L. clymenum* were collected from 12 sites. This paper includes geographical origin and agronomical and chemical features of these accessions.

II – Materials and methods

To collect cultivated *Lathyrus* populations in all Turkey, locations where *Lathyrus* species are cultivated were determined. These locations are: Adıyaman (1), Burdur (2), Bursa (3), Çankırı (4), Denizli (5), Elazığ (6), Kütahya (7), Malatya (8), Nevşehir (9), Samsun (10), Uşak (11), Mugla (12), (Fig. 1). Then, expeditions were carried out in these locations in Autumn 2007. During expeditions, 45 *Lathyrus* populations (44 of *L. sativus*, 1 of *L. clymenum*) were collected from 12 locations (Table 1). Three of the *L. sativus* populations are commercial and the others are household material. Also, the only released *Lathyrus* variety of Turkey 'Gurbuz- 2001' (*L. sativus*) was obtained from Central Research Institutes for Field Crops. Each population was taken from different farmers by recording altitudes of location. For original seeds, 1000 seeds weight and seed colors were determined. Crude protein content was determined by Kjeldahl method in the original seeds. Collected seeds were sown to determinate crude protein of their hay (at the 50% flowering stage) in November 2007 in Ondokuz Mayıs University experimental field, and were harvested in July 2008. Forage samples were dried at 68°C during 24 hours. Then hay samples were milled (particle size 2 mm) and analyzed by using NIRS (Foss 6500)^R.

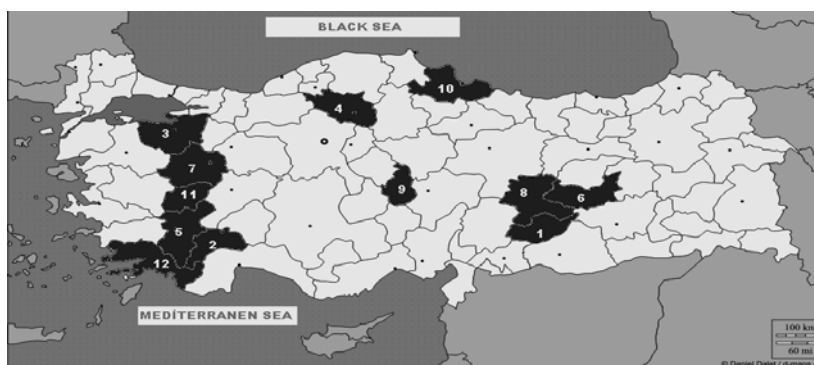


Fig. 1. Locations where *Lathyrus* samples were collected in Turkey.

Table 1. Colors, location features and uses of *Lathyrus* species in Turkey, crude protein contents of seeds and hay, and thousand seed weights[†]

L	Species	Seed color [†]	Altitude (m)	Uses	CP (seed ^{††}) (%)	1000 seeds ^{††} weight (g)	CP (hay) (%)
1	<i>L. sativus</i>	G	825	Feed	30.89	92.0	23.20
	<i>L. sativus</i>	G	787	Feed	28.03	84.9	23.42
2	<i>L. sativus</i>	G	787	Feed/food	30.04	110.6	22.24
	<i>L. sativus</i>	G	1093	Feed/food	31.68	86.4	24.19
	<i>L. sativus</i>	G	787	Feed/food	30.10	94.4	23.26
3	<i>L. sativus</i>	G+W	690	Feed/food	30.47	102.3	24.33
	<i>L. sativus</i>	G+W	690	Feed/food	27.93	134.0	24.10
	<i>L. sativus</i>	G+W	760	Feed/food	28.10	107.3	24.75
	<i>L. sativus</i> ^{†††}	G	–	Feed/food	27.61	99.6	22.64
4	<i>L. sativus</i>	G	768	Feed	27.98	97.8	24.20
	<i>L. sativus</i>	G	768	Feed	28.00	122.6	24.09
	<i>L. sativus</i>	G	957	Feed	29.35	104.7	24.02
5	<i>L. sativus</i>	G	1148	Feed	29.34	76.3	23.42
	<i>L. sativus</i>	G	1013	Feed	30.10	80.6	22.22
	<i>L. sativus</i>	G	934	Feed	26.96	121.5	24.43
	<i>L. sativus</i>	G	841	Feed	26.50	77.2	22.57
	<i>L. sativus</i>	G	886	Feed	26.23	73.3	22.28
	<i>L. sativus</i>	G	887	Feed	26.45	90.5	22.08
	<i>L. sativus</i>	G	900	Feed	27.18	101.5	22.56
	<i>L. sativus</i>	G	995	Feed	29.24	106.3	23.73
6	<i>L. sativus</i>	G	987	Feed	27.34	72.2	23.12
	<i>L. sativus</i> ^{†††}	G	–	Feed	27.80	89.94	23.80
	<i>L. sativus</i>	G+W	880	–	30.41	118.6	24.98
8	<i>L. sativus</i>	G	1600	Feed	30.33	80.8	22.91
	<i>L. sativus</i>	G	1600	Feed	28.62	101.8	22.00
	<i>L. sativus</i>	G	1445	Feed	28.16	103.3	21.63
	<i>L. sativus</i>	G	–	Feed	27.02	129.0	19.03
9	<i>L. sativus</i>	G	1120	Feed	28.84	106.5	22.75
	<i>L. sativus</i>	G	1159	Feed	28.69	102.2	22.78
	<i>L. sativus</i>	G	880	Feed	27.99	112.2	25.10
	<i>L. sativus</i>	G	1000	Feed	27.63	103.4	23.78
	<i>L. sativus</i>	G	1086	Feed	26.22	140.8	21.89
	<i>L. sativus</i>	G	1113	Feed	28.79	113.6	22.99
10	<i>L. sativus</i>	W	600	Feed	24.07	148.0	–
11	<i>L. sativus</i>	G	960	Feed	28.21	95.4	24.05
	<i>L. sativus</i>	G	960	Feed	29.30	107.3	23.78
	<i>L. sativus</i>	G	770	Feed	29.71	85.0	24.18
	<i>L. sativus</i>	G	770	Feed	30.23	90.3	26.20
	<i>L. sativus</i>	G	938	Feed	28.77	88.3	22.67
	<i>L. sativus</i>	G	743	Feed	29.78	75.3	23.71
	<i>L. sativus</i>	G	743	Feed	28.60	107.5	24.06
	<i>L. sativus</i>	G	800	Feed	26.60	76.8	24.16
	<i>L. sativus</i>	G	800	Feed	27.63	104.0	23.65
	<i>L. sativus</i>	G	780	Feed	27.78	85.4	24.72
	12	<i>L. clymenum</i>	G	15	Food	26.33	118.8
<i>L. sativus</i> ^{††††}		G	–	Feed	25.81	117.8	24.30

[†]G: grey; W: white; L: location; CP: crude protein.

^{††}Original seeds.

^{†††}Commercial material.

^{††††}Released species, named 'Gürbüz-2001'.

III – Results and discussion

During the expeditions, a total of 45 *Lathyrus* accessions, belonging to *L. sativus* and *L. clymenum* species, were collected from 12 locations. *L. ochrus* and *L. cicera*, which were reported by some authors (Genc ve Sahin, 2001) as being cultivated, were not found. *Lathyrus* cultivation is spread through many parts of Turkey and almost all of the cultivated populations belong to *L. sativus* species.

Their local names are, "murdumuk", "culban", "feslek" and "fasil" in different locations. *Lathyrus* was generally cultivated in inner regions and at height altitudes (600-1600 m) in Turkey (Table 1). All the farmers stated that they traditionally sow *Lathyrus* in early spring, so resistance to cold of the populations is not clear.

L. sativus is cultivated mainly as feed in Turkey. However, it is rarely used as food. For this reason, there is no lathyrism risk for humans in Turkey. According to farmers, *L. sativus* has higher seed yield than other legumes especially in dry conditions and has not shattering characters. So farmers grow *Lathyrus* more for seed than for forage. For animal feeding, seeds are used by soaking in water or grinding and mixing with cereals. Maybe this process is reason why lathyrism is not observed in animals in Turkey, as neurotoxic ODAP is a water-soluble amino acid that can be leached from seed by soaking in water (Akalu *et al.*, 1998). In Turkey, *L. sativus* was used for human consumption in a few locations as a soup, pilaf or snack (mixing with chickpea). As for *L. clymenum*, it was grown for household consumption in small fields. Its seeds were used only in a local vegetable food in the location numbered 12 (Table 1).

To determinate CP content in hay, original seeds were sown in same conditions and then harvested at 50% flowering stage. The range of 50% flowering stage among populations is 13 days, and hay CP contents varied from 19.03% to 26.20%. According to other studies, *L. sativus* contains 26.3%-34.3% protein in seeds and 13.8%-20.1% protein in the stems and leaves (Hanbury *et al.*, 2000). Lary and Abd El Moneim (1995) reported that 1000 seeds weight were 34.5-225.9 g in many *L. sativus* genotypes. Our results show that there is a high variation among collected *L. sativus* populations in terms of CP and 1000 seeds weight. The variation for CP in original seeds can be expected by the different ecological conditions of growing. But, similarly, there is high variation for CP content in hays, although they were all grown in the same conditions. So this variation is may result from genetic or ecologic factors as well.

IV – Conclusions

L. sativus has considerable potential as feed or food crop in Mediterranean-type environments. In Turkey, farmers stated that *L. sativus* has higher seed yield than other legumes in poor soils and under drought conditions. In addition all the cultivated materials are local varieties. This means that higher yields may be possible with suitable cultivars improved by breeders. The variability in collected *Lathyrus* samples, in terms of the investigated features, indicated that these populations are promising materials for breeding. But new studies are needed to determine their genetic differences and the ODAP contents for the safe use in animal or human consumption of these populations.

Acknowledgements

The authors wish to acknowledge the financial support received from the Ondokuz Mayıs University.

References

Acar Z. and Basaran U., 2007. Determination of morphological, agricultural and cytological characters of some *Lathyrus* species. In: *Asian Journal of Chemistry*, 19(7), p. 5625-5633.

- Akalu G., Johansson G. and Nair B.M., 1998.** Effect of processing on the content of b-N-oxalyl-a,b-diaminopropionic acid (b-ODAP) in grasspea (*Lathyrus sativus*) seeds and flour as determined by flow injection analysis. In: *Food Chem.*, 62(2), p. 233-237.
- Campbell C.G., 1997.** Grass pea. *Lathyrus sativus* L. Promoting the conservation and use of underutilized and neglected crops. 18. Institute of Plant Genetics and Crop Plant Research. Gatersleben/International Plant Genetic Resources Institute, Rome, Italy.
- Davis P.H., 1970.** *Flora of Turkey and East Aegean Islands*. Edinburgh University Press, p. 328-369.
- Genc H. and Sahin A., 2001.** Batı Akdeniz ve Güney Ege Bölgesinde yetişen Bazı *Lathyrus* L. türleri üzerinde sitotaksonomik araştırmalar. III. In: *S.D.Ü. Fen Bilimleri Dergisi*, 5:1, p. 98-112.
- Hanbury C.D., White C.L., Mullan B.P. and Siddique K.H.M., 2000.** A review of the potential of *Lathyrus sativus* L. and *L. cicera* L. grain for use as animal feed. In: *Animal Feed Science and Technology*, 87, p. 1-27.
- Lambein F., Khan J.K., Kuo Y.H., Campbell C.G. and Briggs C.J., 1993.** Toxins in the seedlings of some varieties of grass pea (*Lathyrus sativus*). In: *Nat. Toxins*, 1, p. 246-249.
- Larry D.R. and Abd El Moneim A.M., 1995.** *Lathyrus* germplasm collection, conservation and utilization for crop improvement at ICARDA. In: *IPGRI-ICAR/IGAU Regional Workshop on Lathyrus Genetic Resources in Asia*, Raipur (India), 27-29 December.
- Mehta S.L., Ali K. and Barna K.S., 1994.** Somaclonal variation in a food legume – *Lathyrus sativus*. In: *J. Plant Biochem. Biotechnol.*, 3, p. 73-77.
- Plitmann U., Gabay R. and Cohen O., 1995.** Innovations in the tribe Viciaeae (Fabaceae) from Israel. In: *Isr. J. Plant Sci.*, 43, p. 249-258.
- Rosa M.J.S., Ferreira R.B. and Teixeira A.R., 2000.** Storage proteins from *Lathyrus sativus* seeds. In: *Journal of Agricultural and Food Chemistry*, 48, p. 5432-5439.
- Tekele-Haimanot R., Kidane Y., Wuhib E., Kalissa A., Alemu T., Zein Z.A. and Spencer P.S., 1990.** Lathyrism in rural Northwestern Ethiopia: A highly prevalent neurotoxic disorder. In: *Int. J. Epidemiol.*, 19, p. 664-672.
- Wang F., Chen X., Chen Q., Qin X.C. and Li Z.X., 2000.** Dedermination of neurotoxin 3-N-oxalyl-L-2,3-diamino propionic acid and non-protein amino acids in *Lathyrus sativus* by precolumn derivatization with 1-fluoro-2,4-dinitrobenzene. In: *J. Chromatogr. A.*, 883, p. 113-118.
- Yan Z.Y., Spencer P.S., Li Z.X., Liang Y.M., Wang Y.F., Wang C.Y. and Li F.M., 2006.** *Lathyrus sativus* (grass pea) and its neurotoxin ODAP. In: *Phytochemistry*, 67, p. 107-121.