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# Variation in seed yield and morphological traits in Turkish grass pea (*Lathyrus sativus*) genotypes

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**Abstract.** In this study 51Turkish landraces, 4 ICARDA lines and 1 registered variety of *Lathyrus sativus* L. were investigated for morphological characters and seed yield. The experiment was carried out in Samsun ecological conditions in 2009 with spring-sown. A high variation was determined among genotypes regarding the investigated characters, especially in seed yield and thousand seed weight. The variation among the *Lathyrus sativus* genotypes was between 2.82 g/plant and 13.64 g/plant for seed yield and between 5.10 g/plant and 22.89 g/plant for biological yield and between 91.65 g and 167.70 g for thousand seed weight. Many of the landraces had higher seed yield and thousand seed weight than registered cultivar named "Gurbuz 2001". Correlation analysis showed that biological yield, stem number, pod number per plant and petiole length highly and positively correlated with seed yield.

**Keywords.** Grass pea – *Lathyrus* – Landrace – Seed yield.

***Variation du rendement en graines et des caractéristiques morphologiques chez des génotypes Turques de gesse commune* (Lathyrus sativus)**

***Résumé.*** *Dans cette étude, 51 variétés locales turques, 4 lignes de l'ICARDA et 1 variété enregistrée de* Lathyrus sativus *L. ont été étudiées pour les caractères morphologiques et le rendement en graines. L'expérience a été réalisée en 2009 dans des conditions écologiques de Samsun, en semis de printemps. Une forte variation a été déterminée chez les génotypes dans les caractères étudiés, en particulier dans le rendement en graines et dans le poids de mille graines. Les différences entre les génotypes de* Lathyrus sativus *étaient comprises entre 2,82 g/plant et 13,64 g/plant pour le rendement grainier, entre 5,10 g/plant et 22,89 g/plant pour le rendement biologique, et entre 91,65 et 167,70 g pour le poids de mille graines. Beaucoup d'entre les genotypes locales avaient un rendement des semences et un poids de mille graines plus élevé que ceux du cultivar enregistré "Gurbuz 2001". L'analyse de corrélation a montré que le rendement biologique, le nombre de tiges, nombre de gousses par plante et la longueur du pétiole sont fortement et positivement corrélés avec le rendement en graines.*

***Mots-clés.*** *Gesse* – Lathyrus – *Genotype local* – *Rendement en graines.*

## I – Introduction

*Lathyrus sativus* "LS" is an important annual legume crop used for food, feed and forage in many parts of the world especially in drought and marginal areas (Campbell, 1997). The crop is valued for its high yield, high protein content, drought tolerance, low input requirement, adaptation to diverse soils and climates, resistance to insects and pests (Yan *et al*. 2006). Recently, due to the advantageous biological and agronomic characters, LS is gaining interest as a model crop for sustainable agriculture and is considered as an important source of genes in the legume breeding for both biotic and abiotic stress resistance (McCuthan, 2003).

In spite of the importance of *Lathyrus* for human and animal nutrition, the utilization of the grain is limited due to the presence of the neurotoxic compound 3-(-N-ox-alyl)-L-2,3 diaminopropionic acid (b-ODAP), that causes Lathyrism disease when seeds are consumed as a major component of the diet (Spencer *et al.* 1986). In general, breeding programs mainly focused on improving a genotype having high seed yield and low neurotoxin level. Therefore, the aim of the present study was to determine the variation in seed yield and morphological traits of Turkish *Lathyrus sativus* landraces and ICARDA lines.

## II – Materials and methods

A total of 56 genotypes of *Lathyrus sativus* were investigated relation to seed yield and some morphological traits, 51 landraces from Turkey, one released cultivar "Gurbuz-2001" and 4 ICARDA lines (Table 3). Field experiments were conducted in Agricultural Faculty experiment field of Ondokuz Mayis University, Samsun (264972 E – 4581185 N, UTM) - Turkey in 2009 spring growing season. The field experiment was established on April 4 with no fertilizer at 15 cm seed to seed and 30 cm row to row spacing. Each landrace or line was sown one plot (3 m length with 3 rows), all the traits were determined on randomly selected ten plants at the seed maturity stage between July 19 and July 26 depending on genotype. All the data were presented as a mean, minimum, maximum, and standard deviation, in addition, Correlation and Principle Component Analysis were performed by means of 13.0 Statistical Package Program.

## III – Results and discussion

The results showed that there was high variation between the investigated characters among the Turkish *Lathyrus sativus* "LS" genotypes (Table 1). The range from sowing to seed maturity time among to LS genotypes was eight days (105-113). The earliest genotype was registered variety "Gurbuz 2001" while the latest genotype was landrace S. The plant height (PH) varied from 30.00 to 48.10 cm with a mean of 37.13 cm and, petiole length (PL) was between 1.46 and 4.22 cm among to LS genotypes. Campbell (1997), reported that plant height ranged from 15 to 172 cm in LS originating different countries. The highest variation among to investigated LS genotypes was observed in relation to seed yield (CV = 38.52%), ranging between 2.82 and 13.64 g/plant while the lowest variation (CV = 6.88%) was in pod length (PDL). Also the variation was very high for biological yield (BY), number of stems per plant (NSM), number of pods per plant (NPP), but it was low for seed number per pod (NSP) among to LS genotypes. The average thousand seed weight (TSW) in investigated LS genotypes amounted to 115.56 g (with a range of 91.60 – 167.70 g) (Table 1). In the previous studies, SY of LS reported between 0.5 – 21.19 g/ plant (Pandey *et al.* 1997; Polignanao *et al.* 2005). TSW is an origin-dependent trait and the genotypes collected from the Mediterranean basin have higher seed weight than genotypes collected from the Indian subcontinent (Campbell, 1997). In this respect, although Turkey located in the Mediterranean basin, relatively low TSW values observed in the present study compare to Grela *et al.* (2010) who reported TSW was between 120 and 660 g among to thirty-one European accessions.

Seed yield was positively and highly correlated with all the traits, especially with BY, NSM and NPP ($r = 0.988^{**}$, $0.658^{**}$ and $0.851^{**}$ respectively) (Table 2). In general, correlations between all the traits were positive except TSW and NSP, and in agrement with previous studies. One of the important finding of this study that is positive and high correlation between SY and PL ($r = 0.413^{**}$). It is intersting because no referans can found relation to PL for *Lathyrus sativus* in earlier studies. Moreover, this correlation indicating that PL may be used for selection of high yielding genotypes at the early stage.

**Table 1. Mean, maximum and minimum values of some traits in 56 *Lathyrus sativus* genotypes**

| Traits | Mean ± sd | Minimum | Maximum | CV (%) |
|---|---|---|---|---|
| Plant height (cm) | 37.13 ± 4.35 | 30.00 | 48.10 | 11.72 |
| Petiole length (cm) | 2.00 ± 0.41 | 1.46 | 4.22 | 21.00 |
| Leaf length (cm) | 6.43 ± 0.60 | 5.02 | 7.84 | 9.33 |
| Biological yield (g/plant) | 11.11 ± 3.95 | 5.10 | 22.89 | 35.55 |
| Seed yield (g/plant) | 5.97 ± 2.30 | 2.82 | 13.64 | 38.52 |
| Number of the stem per plant | 6.13 ± 2.14 | 3.00 | 11.80 | 34.91 |
| Number of the pod per plant | 17.50 ± 5.71 | 9.00 | 33.40 | 32.62 |
| Pod length (cm) | 3.05 ± 0.21 | 2.43 | 3.66 | 6.88 |
| Number of the seed per pood | 3.40 ± 0.33 | 2.70 | 4.17 | 9.71 |
| Thousand seed weight (g) | 115.56 ± 9.91 | 91.65 | 167.70 | 17.23 |

**Table 2. Correlations between investigated traits among to 56 *Lahyrus sativus* genotypes originating Turkey and ICARDA**

| Traits | PH | PL | LL | BY | SY | NSM | NPP | PDL | NSP |
|---|---|---|---|---|---|---|---|---|---|
| PL | .349** | | | | | | | | |
| LL | .565** | .263 | | | | | | | |
| BY | .343** | .427** | .351** | | | | | | |
| SY | .329* | .413** | .343** | .988** | | | | | |
| NSM | .115 | .441** | .156 | .682** | .658** | | | | |
| NPP | .227 | .467** | .236 | .877** | .851** | .629** | | | |
| PDL | .369** | .295* | .100 | .429** | .455** | .238 | .173 | | |
| NSP | .180 | .052 | -.013 | .096 | .067 | -.092 | .123 | .080 | |
| TSW | .187 | .151 | .311* | .393** | .437** | .271* | .102 | .555** | -.409** |

**, *: Correlation is significant at the 0.01 and 0.05 level respectively.

PLH plant height, PL: petiole length, LL: leaf length, BY: biological yield, SY: seed yield, NSM: number of the stem per plant, NPP: number of the pod per plant, PDL: pod length, NSP: number of the seed per pood, TSW: thousand seed weight.

Principle component analysis (PCA) based on SY, NSP and TSW indicated that the first two principle components explained 87.76 % of the total variation (Fig. 1). PC1 correspond to 52.18 % of the variation and PC2 to 27.00%. In the first component, the most important contribution were related to TSW while second component was mainly loaded by SY and NSP (Table 4). The obtained scatter plot using these first two components is shown in Fig. 1. Distribution of the LS genotypes on scatter plot indicated that many of landraces especially those are BR1, BR2, BR3, BR4, D4, U7, I1, I2, S, K were clearly superior compare to registered cultivar (GR) regarding both SY and TSW, therefore, they were most promising genotypes for improving new and high yielding varieties (Fig. 1).

## IV – Conclusions

Sustainable and environmentally sound agricultural systems have renewed the importance of *Lathyrus sativus* and, the lack of varieties has favored breeding programs. Local materials and old landraces are present an important and diverse gene pool to breeders. The present study showed that Turkish LS genotypes may be promising for breeding study with high variation especially in seed yield.

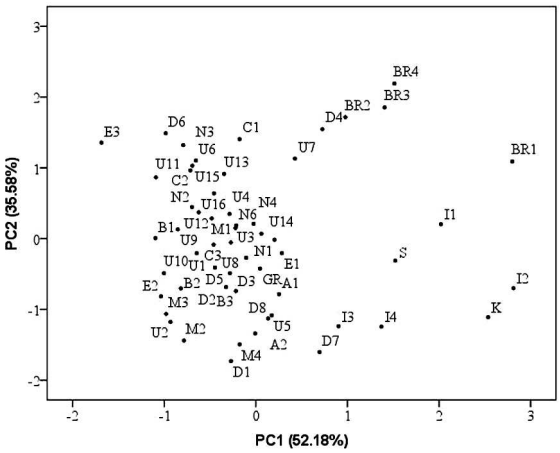


**Fig. 1. PCA on seed yield, seed number per pod, TSW of *Lathyrus sativus* genotypes.**

**Table 3. Origin of the LS genotypes**

| Getp. | Origin | Getp. | Origin |
|---|---|---|---|
| A | Adiyaman | K | Kutahya |
| B | Burdur | M | Malatya |
| BR¡ | Bursa | N | Nevsehir |
| C | Cankiri | S | Samsun |
| D | Denizli | U | Uşak |
| E | Elazıg | I | ICARDA |
| GR | Registered variety | | |

**Table 4. Correlation of the analyzed three traits with the first two component**

| Traits | Component | |
|---|---|---|
| | 1 | 2 |
| SY | .404 | .661 |
| NSP | -.372 | .707 |
| TSW | .581 | -.007 |

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