СЕЛСКОСТОПАНСКА АКАДЕМИЯ
AGRICULTURAL ACADEMY
РАСТЕНИЕВЪДНИ НАУКИ, **50**, 37-40
PLANT SCIECE, **50**, 37-40
София, 2013, Sofia

CHEMICAL CHARACTERIZATION OF PEA IN BULGARIAN COLLECTION

SIYKA ANGELOVA, MARIYA SABEVA
Institute of Plant Genetic Resources "K. Malkov", Sadovo, Bulgaria
E-mail: siika_angelova@yahoo.com

Abstract

The pea collection contains plant genetic resources with different origin, level of breeding and botanical possessing, which gives opportunities for improvement of the breeding program in different directions.

The characterization of 100 samples was done during the last 5 years. They give very good information about the plant material of peas conserved in the gene bank and represent an extract from the sustained collection.

Main aims are searching of a relation between the chemical characteristics (crude protein, crude fibre, crude ash, tannins) and phenotype, productivity etc. of the accessions.

The research of correlations between the characters doesn't show expressive dependence at the accessions.

Only a weak negative correlation between fibre and protein is observed.

By substance of crude protein of the varieties there is no dependence between the morphologic characteristics of seeds, the mass of 100 seed, phenotype.

Grouping of all accessions according to the most important biochemical characteristics give possibilities for searching a donors and creating new productive cultivars with high quality.

Key words: pea, collection, protein, characterization, seeds

INTRODUCTION

Pea is a long established and significant crop in Europe. The increasing need of protein-rich raw materials for animal feed or intermediary products for human nutrition have led to a greater interest in these plants as a protein source (Baniel, Bertrand, Lelion and Gueguen, 1998).

The national pea collection in Sadovo contains plant genetic resources with different origin, level of breeding and botanical possessing, which gives opportunities for improvement of breeding program in different directions: food, cannery industry and forages (Angelova, Sabeva, 2008).

Systematization of assessment information gathered from ex situ pea collection along with chemical characterization creates possibilities for increasing the effectiveness of a breeder's programme (Angelova, 2001; Angelova, Stoilova, 2009).

The current publication makes a chemical characterization of the representative samples, interaction between biochemical components, morphology and seed weight. A representative excerpt of 100 accessions was used which gives information for conserved pea plant material.

MATERIAL AND METHODS

As a result of a complex description of pea collection during 2005 – 2008 a representative sample of 100 accessions that gives accurate information for the plant material in long-term storage was made. The main requirements of breeding as well as the seed presence in the exchanged collection of the gene bank were also taken into consideration.

These 100 specimens were planted in experimental field IPGR Sadovo and assessed according to international descriptors (Angelova, Koeva, Kitcheva and Yantcheva, 2005; Coyne, Grusak, Razai, Baik, 2005).

The sample includes representatives of *P. stivum* subsp. *sativum* L., *P. sativum* subsp. *arvence,* common and afila type.

Pea mature seeds were produced in the field. In this period seeds were respectively harvested from 240 m 2 according to the international descriptors.

Chemical analysis includes the substance of crude protein, crude fiber, and sugar in dry seeds and green mass (Osborne, Voogt, 1978).

Samples for analysis were taken at optimal stages of maturation.

The choice of the accessions in small *ex situ* field collections was made and conformed to: direction of breeding, utilization, agrobiological characters simple status botanical classification and seed morphology.

RESULTS AND DISCUSSION

The Pea collection is the biggest of all grain legume species. The total number is 2560 accessions. About 25% of pea collection is in long term conservation, 50% in middle term and 25% in working collection. The pea collection is introduced from 30 countries in the world. The accessions with foreign origin include mainly varieties and breeding lines with a specific quality – donors

for breeding base material. The plant material with Bulgarian origin occupy about 25%: local populations, old and new breeding varieties, breeding lines and mutant forms (Angelova, Stoilova, 2000; Angelova, 2001; Angelova, Koeva, Kitcheva and Yantcheva, 2005).

The investigation made during the period 2005 – 2008 gives opportunity to deal the species from the collection depending of their maturation in 5 more important groups (Figure 1).

The most variability by the productivity was super early and very late accessions. The best realization of the potential productivity was observed on the early maturation accessions, independent of their utilization. The medium early accessions showed high results of productivity, but there were some hesitates of the yield under different production years. (Angelova, Sabeva, 2008; Angelova, Stoilova, 2009).

The three groups were the most important for breeding program – super early, early and medium maturation accessions (Stoilova, 2000; Angelova et al., 2005).

The duration of the vegetative period in spring sowing them in 68 to 80 days, and in autumn – from 162 to 178.

The accessions are very different by productivity: number (30 - 105) and weight (8 - 19 g) of seeds per plant.

The seed yield varies from 200 to 500 kg/ha in spring forms, from 280 to 350 kg/ha in winter forms and mass of 100 seeds from 16.0 to 36.8 g (Angelova, Sabeva, 2008; Angelova, Stoilova, 2009).

Spring varieties form the seed yield of pea from the main stem. In the years, winter samples have uniform distribution of the pods as the central stem and the all branches. In cold and dry winter conditions, they form the pods only on the branches. (Angelova, 2001; Angelova, Sabeva, 2008; Angelova, Stoilova, 2009).

The chemical seed characterization is presented in Figure 2 – 5.

Data from chemical analysis showed that the main distribution of crude protein is in the range of 23% to 32%.

The accessions are classified in four groups depending on the crude protein content. The greater

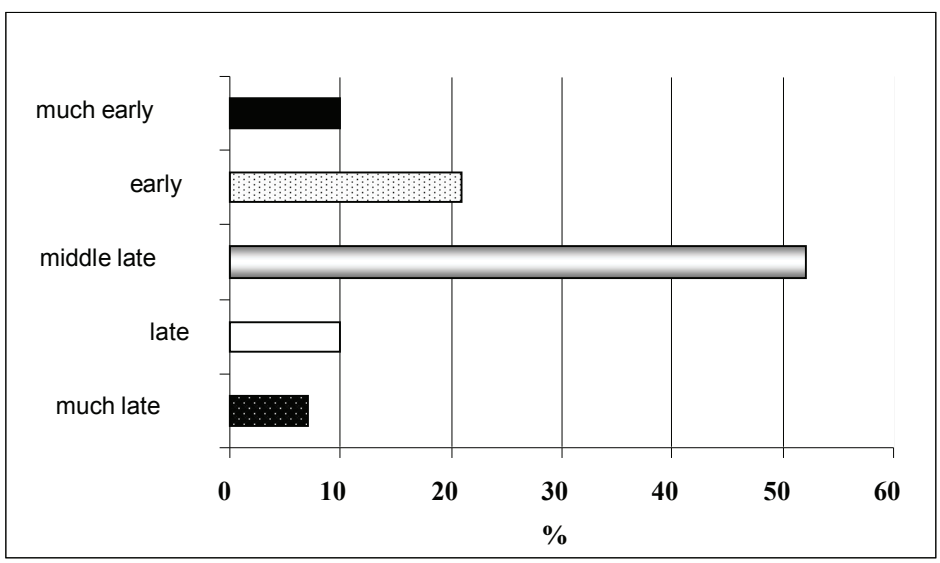

Fig. 1. Distribution of samples at maturity

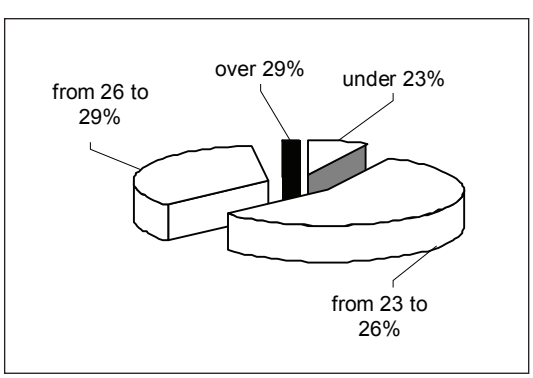

Fig. 2. Crude protein content in dry seeds

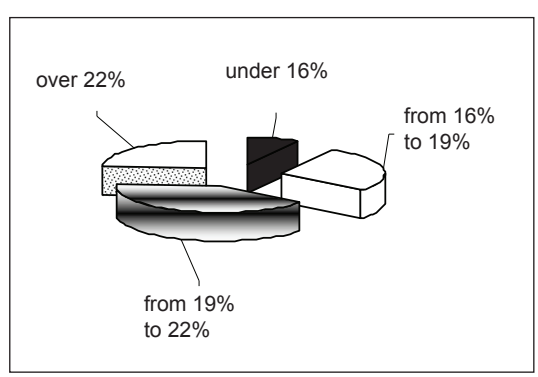

Fig. 3. Crude fibrecontent in dry seeds

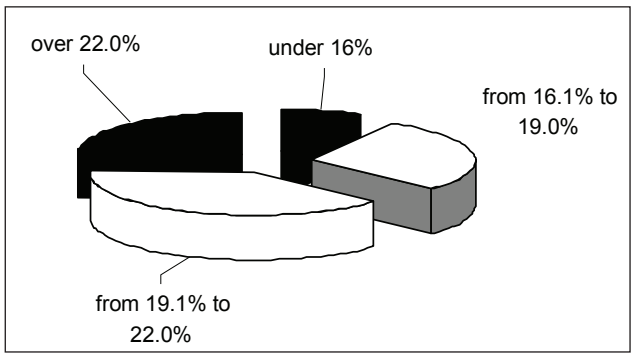

Fig. 4. Crude protein content in green mass

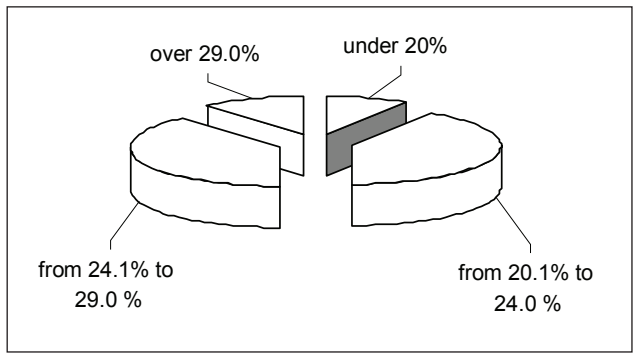

Fig. 5. Crude fibre content in green mass

Table 1. Crude protein content and seed morphology and size

Groups	Crude protein, %	Seed morphology			Weight/ 100 seeds	Directions of use
		surface	pigmentation	shape		
I-st	under 23%	Sm	light green light beige light yellow	round	from 16.0 to 20.7 g	forage, dry grain
II-nd	from 23.1% to 26.0%	Sm Wr	patterned light and dark green light beige	oval, quadratic oblong	from 16.0 to 28.8 g	forage, dry seeds garden pea
III-rd	from 26.1% to 29.0 %	Sm	dark and light green, beige and light beige	oval, quadratic-round	from 21.0 to 30.2 g	dry seeds garden pea
IV-th	from 29.1% to 32.0%	Wr Sm	green, light green and light yellow	quadratic	from 25.0 to 36.8 g	garden pea dry seeds

Sm – smoothly, Wr – wrinkled.

Table 2. Evaluation of pea accessions for 2000 – 2005

№	Species variety	Origin	Height/ pl	Seed yield	Weight of 100 seeds, g	Seed characterization		
						color	seed surface	crude protein content, %
1	MIR	Bg	9	7	20.8	coloured	Sm	22.5
2	№11	Bg	5	5	16.5	yellow	Sm	24.3
3	Vesela	Bg	7	7	22.6	yellow	Sm	23.8
4	Pleven 4	Bg	7	5	21.7	yellow	Sm	24.0
5	Druzhba	Bg	9	5	18.4	green-yellow	Sm	25.0
6	Amitie	Bg	5	7	24.5	light green	Sm	24.0
7	Pikardi	Bg	5	7	22.8	light green	Sm	23.5
8	Tedy	Bg	5	7	24.8	green	Sm	23.1
9	Solara	Fr	5	5	27.8	yellow-green	Sm	24.3
10	Meteor	Fr	5	5	25.6	green	Wr	25.8
11	470-21	Fr	3	5	27.2	light green	Sm	24.8
12	470-22	Fr	5	5	26.7	yellow	Sm	24,0
13	470-24	Bg	3	7	29.4	green	Sm	25.7
14	85202030	USA	3	3	32.2	dark green	Wr	27.1
15	85202215	USA	1	3	35.2	dark green	Wr	26.6

part of them are in second and third group. 90% of the accessions in the forth group belong to the vegetable group (Table 1, 2).

The first group (under 23%) includes preferably spring forms. The seeds in this group are with smooth and round form and light color.

Mainly early varieties and breading lines from ordinary and afila type belong to the second group (23.1 – 26%). The seeds have smooth surface, variegated color and mass of 100 seeds from 16.00 to 28.0 g.

The third group has (26.1 to 29%) early, middle early and some late accessions with a different direction of utilization – forage, dry and fresh grain. The seeds are with smooth and wrinkled surface and variegated color. The mass of 100 seeds is from 16.0 to 35.2 g.

The forth group (29.1 – 32.0%) includes forms with wrinkled surface and green color of the seeds predominates. They are mainly vegetable type.

Higher protein content in seeds during the study is found in some samples rosette type, forming large pods and seeds with wrinkled surface (Table 1).

The substance of the crude fibre in dry seeds ranges within 19% to 23%. The simples are divided into 4 groups. The biggest group is the third from 19.1% to 22% (Figure 3).

The crude protein content in the green mass of the studied accessions varies from 16% to 24.5%.

On this character samples are also divided into four groups as the majority part belong to a third (19 to 22%) prevalent where varieties typically for green mass.

The fourth group includes samples with large leaves and stipules, and more branches (Figure 4).

The crude fiber content in the green mass is high and it varies from 18.1% to 30.0% (Figure 5).

Dominated samples (50%) having a crude fiber content from 20% to 24%. They refer to a group of green fodder.

The protein content isn't determined and does not depend on the seed morphology and weight (Table 1).

In our study in 15 samples was analyzed relationship between: yield, plant height, seed color, shape of the seed, weight of 100 seeds and crude protein content in full maturity. During the years of the study samples peas fall into different groups and a tendency for interaction between the studied parameters was not established (Table 2).

The results indicate that correlation ship between chemical characters is not observed. Slight negative correlation was observed only between the content of crude protein and crude fiber. At the grouping of the varieties by substance of crude protein there is no dependence between the morphologic characteristics of seeds, the mass of 100 seed, and phenotype.

CONCLUSIONS

The chemical evaluation of the representative sample from 100 accessions by crude protein, crude fibre and sugar content, gives the investigations a possibility to continue in direction of protein quality, nutritional and forage value.

The pea collection could be used in different directions. By grouping on the chemical components.

There is no dependence between productivity, morphologic characteristics of seeds and crude protein.

REFERENCES

Angelova, S., Tz. Stoilova. 2000. Grain legume collections in Bulgaria, Report of a Working Group on Grain Legumes, Newslett. IPGRI, Rome: 41-43

Angelova S. 2001. Maintence, enrichment and preservation of grain legume collections, 3 th Meeting, Krakow, Poland, p. 56-59

Angelova, S., Koeva, R., Kitcheva, P. and Yantcheva, Ch. 2005. Possibility for utilization of grain legume collections in Bulgaria. *Plant Sci.*, 42: 64-68

Angelova, S., M. Sabeva. 2008.Characterization of plant genetic resources of peas depending to the utilization. Ecology and health, Proceedings of VII-th Scientific-technical conference with international participation, p. 153-159.

Angelova, S., Tz. Stoilova. 2009. Maintenance, enrichment and preservation of grain legume collections in Bulgaria. Proceeding of the Fourth Balkan Symposium on Vegetable and Potatoes, vol. 2, ISHS, *Acta Horticulture*, 830, p. 695-701

Baniel, A, D. Bertrand, A. Lelion and J. Gueguen. 1998. Variability in protein composition of pea seed studied by FLPC and Mulotidimensional analysis. *Crop Science*, vol. 38, p.1568-1575

Coyne, C., M. Grusak, L. Razai, B. Baik. 2005. Variation for pea seed protein concentration in the USDA Pisum core collection. *Pisum Genetics*, 37: 5-9

Herrdge D, O. Rupeia, R. Serraj, D. Beck. 1994. Screening techniques and improved biological nitrogen fixation in cool season food legumes. *Euphytica*, 73, 95-108

Osborne, D., P. Voogt. 1978. The Analysis of Nutrients in Foods. Academic press.