DOI: 10.2478/cerce-2018-0003 **Original Article**
Available online: www.uaiasi.ro/CERCET_AGROMOLD/
Print ISSN 0379-5837; Electronic ISSN 2067-1865

Cercetări Agronomice în Moldova
Vol. LI , No. 1 (173) / 2018: 37-44

FIELD SCREENING OF EUROPEAN *AVENA* GENETIC RESOURCES COLLECTIONS

Danela MURARIU[1]*

*E-mail: dmurariu@suceava.astral.ro

Received Aug. 24, 2017. Revised: Febr. 26, 2018. Accepted: Mar. 08, 2018. Published online: Mar. 27, 2018

ABSTRACT. Oat is a crop with an important European history and tradition. The high value of oat in human nutrition, which is unique among cereals, is widely recognized and confirmed by health claims issued in various countries. It is based on a high content and quality of proteins, considerable content of fat with high proportion of polyunsaturated fatty acids, high contents of dietary fiber, especially the soluble, highly viscous mixed linked (1->3)(1->4)-ß-D-glucans, which hypo-cholesterolemic effects, minerals and antioxidants, especially tocopherols, tocotrienols and avenanthramides. The main goal of this paper is on characterization and evaluation of accessions from European *ex situ* collections for different traits, which are important for the quality of oats in human nutrition. All field experiments carried out in experimental field of Suceava Genebank, during 2014-2016. Field screening of genetic material was performed by using several IPGRI descriptors: days to heading; growth habit; lodging at immature and mature stages; shape of panicle; lemma color; length of panicle; panicle numbers/m^2; plant height; productivity; (g/m^2); seed weight (g) and test weight (kg/hl). A wide variability was observed for all used descriptors, and some genotypes potentially interesting for breeding programs were identified (landraces and obsolete cultivars).

Keywords: landraces; obsolete cultivars; test weight; seed weight; *Avena* accessions.

REZUMAT. Screeningul în câmp al colecţiei de resurse genetice europene de *Avena*. Ovăzul este o cultură cu o importantă istorie şi tradiţie în Europa. Valoarea ridicată a ovăzului în nutriţia umană, ce-l face unic printre cereale, este puternic recunoscută şi confirmată de rezultatele obţinute în diferite studii de sănătate realizate în multe ţări. Aceste afirmaţii se bazează pe conţinutul ridicat de proteine şi pe calitatea acestora, conţinut ridicat de grăsimi ce sunt bogate în acizi graşi nesaturaţi, solubili, cu vâscozitate ridicată (1->3)(1->4)-ß-D-glucani, cu efect hipocolesterolemic, minerale şi antioxidanţi, în special tocoferoli, tocotrienoli şi avenatramide. Principalul scop al acestei lucrări este de caracterizare şi evaluare a probelor provenite din colecţia europeană *ex situ* pentru diferite însuşiri, ce sunt

[1] Suceava Genebank, Romania

importante pentru determinarea calității ovăzului în vederea folosirii în consumul uman. Toate experimentele s-au realizat în câmpul experimental al Băncii de Gene Suceava, perioada 2014-2016. Screeningul în câmp al materialului genetic s-a realizat prin utilizarea unor descriptori IPGRI: nr. zile până la înflorire, tipul de creștere, rezistența la cădere, la coacerea în lapte și la maturitate, forma paniculului, culoarea paleei inferioare, lungimea paniculului, numărul de panicule/m^2, înălțimea plantei, productivitatea (g/m^2), MMB (g) și greutatea hectolitrică (kg/hl). S-a observat o mare variabilitate la toți descriptorii utilizați, evidențiindu-se anumite genotipuri (populații locale, forme sălbatice), ca fiind surse importante pentru ameliorarea ovăzului cultivat.

Cuvinte cheie: populații locale; cultivare vechi; masa a 1000 de boabe; greutate hectolitrică; probe de *Avena*.

INTRODUCTION

In Europe, oat is a crop with an important history and tradition. This crop still has high breeding potential, based on a wealth of genetic resources represented in the European gene banks (Murariu *et al.*, 2013). It is very suitable for organic agriculture, where comparable yields and technical quality can be produced (Saastamoinen *et al.,* 2004; Meyer & Zwingelberg, 1996).

The high value of oat in human nutrition, which is unique among cereals, is widely recognised and confirmed by health claims issued in various countries (*, 1997). It is based on a high content and quality of proteins, considerable content of fat with high proportion of polyunsaturated fatty acids, high contents of dietary fibre, especially the soluble, highly viscous mixed linked (1->3)(1->4)-ß-D-glucans, which hypo-cholesterolemic effects, minerals and antioxidants, especially tocopherols, tocotrienols and avenanthramides (Germeier *et al.,* 2012). Oat is considered moderately susceptible to *Fusarium* infection and mycotoxin contamination (Plăcintă, 2007). Nevertheless, T2/HT-2 toxins raise considerable concerns in the European health administration (European Commission, 2006). Oat growing may be affected by future climate changes leading to more winter cropping and higher *Fusarium* disease pressure with increasing precipitation in the Northern European regions (Bulinska-Radomska *et al.,* 2010).

The focus of this paper is on characterization and evaluation of accessions from European *ex situ* collections for different traits, which are important for the quality of oats in human nutrition.

MATERIAL AND METHODS

Genebank material and current commercial varieties coming from different countries of Europe, were evaluated for traits considered important for future oat breeding in a European premium market. The evaluated working collection contains 567 accessions of hexaploid cultivated oats (*A. sativa* and *A. byzantina*), including 117 commercial cultivars, 46 accessions of diploid cultivated sand oats (*A. strigosa*), five accessions of tetraploid Abyssinian oats (*A. abyssinica*) and 34 wild relatives

of various ploidy levels (*A. fatua*, *A. hybrida*, *A. sterilis*, *A. barabata*, *A. canariensis*, *A. damascena*, *A. hirtula*, *A. wiestii*). Field experiments, laid out in augmented designs with eleven standard cultivars (mainly modern varieties bred in different European countries), were performed widely distributed all over Europe to sample harvest material for quality analysis.

As standard, the following cultivars were used: Argentina, Auteuil, Belinda, Evora, Genziana, Ivory, Jaak, Mina, Mures and Saul. Plot sizes ranged from 2.0 to 3.0 m^2.

Field screening of genetic material was performed by using several IBPGRI descriptors (**, 1985): days to heading; growth habit; lodging at immature and mature stages; shape of panicle; lemma color; length of panicle; panicle numbers/m^2; plant height; productivity; (g/m^2); seed weight (g) and test weight (kg/hl).

RESULTS AND DISSCUSSION

Days to heading

This descriptor is an indirect indicator of the oat plants precocity. The observations made showed the presence of early samples (46 accessions), with a small number of days to heading (65-70 days) belonging to all biological categories (*Fig. 1*). It was also noted that over 54% of the samples could be included in the group of early cultivars (71-80 days).

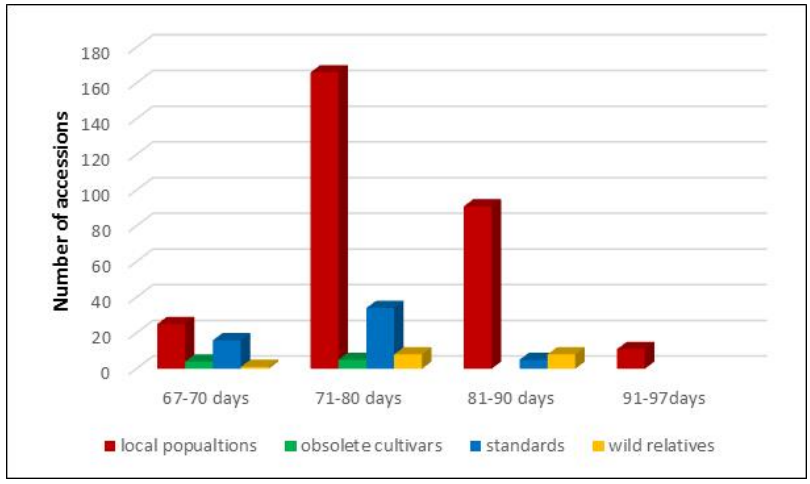

Figure 1 - Days to heading of the *Avena* accessions analyzed in the experimental field

Growth habit

At this descriptor, it was observed that over 65% of the analyzed oat samples had a vertical growth and only 3% had a prostrate growth (*Fig. 2*).

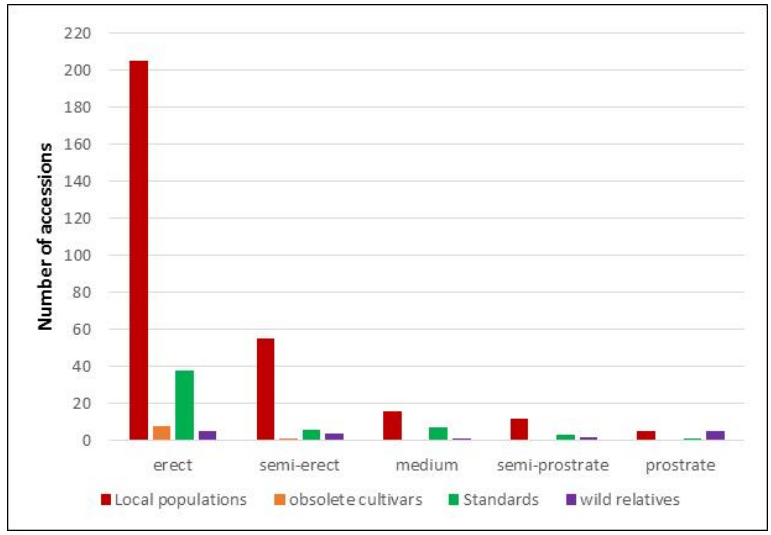

Figure 2 - Growth habit of the *Avena* accessions analyzed in the experimental field

Lodging at immature and mature stages

By analyzing the data obtained from these two descriptors, it noticed that at the beginning of the maturation, over 68% of the populations were very resistant to lodging, but once with the plants maturation, the percentage dropped to 27%. In contrast, the advanced cultivars, and most wild species, retained their lodging resistance to full maturity (*Fig. 3*).

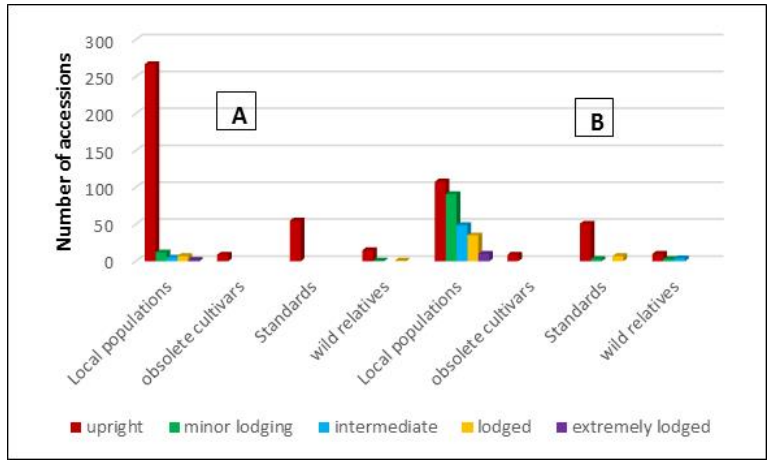

Figure 3 - Lodging at immature and mature stages of the *Avena* accessions analyzed in the experimental field

Shape of panicle

In the analyzed accessions, most oat samples have equilateral panicle (296 samples). Subunilateral and unilateral panicle encountered more in local populations (*Fig. 4*).

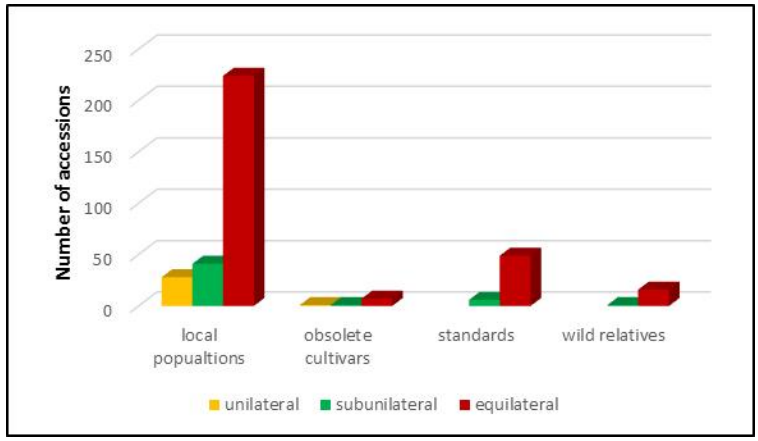

Figure 4 - Shape of panicle of the *Avena* accessions analyzed in the experimental field

Lemma color

This descriptor is an indicator of grain quality. White color is dominant in cultivated forms, and in wild species is predominant brown color (*Fig. 5*).

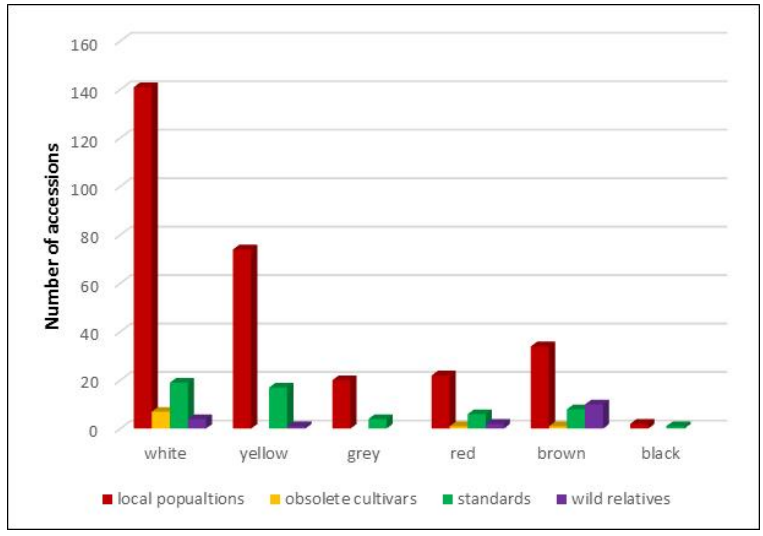

Figure 5 - Lemma color of the *Avena* accessions analyzed in the experimental field

Plant height, length of panicle and panicle numbers/m^2

On the obtained results at the three descriptors, it was observed that the highest value of the plant height was identified in local populations (158 cm), followed by obsolete cultivars (92 cm), standards (128 cm) and wild species (175 cm), being a strong correlation between lodging resistance and plant height (*Fig. 6*).

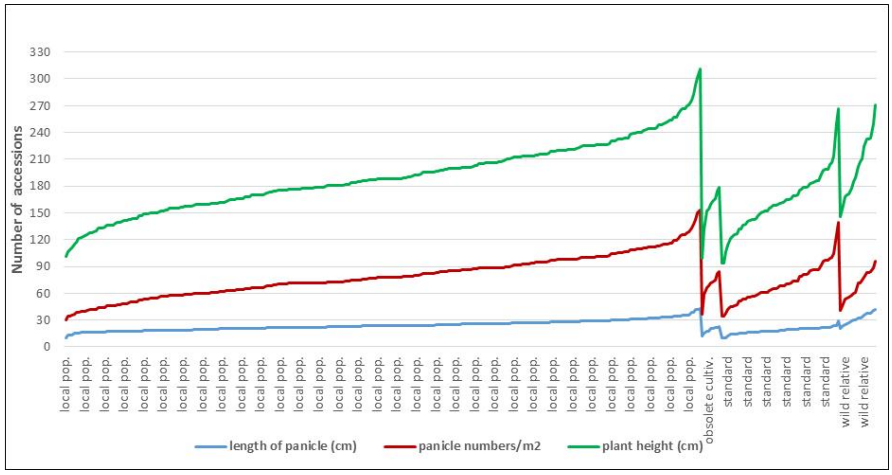

Figure 6 - Plant height, length of panicle and panicle numbers/m^2 of the *Avena* accessions analyzed in the experimental field

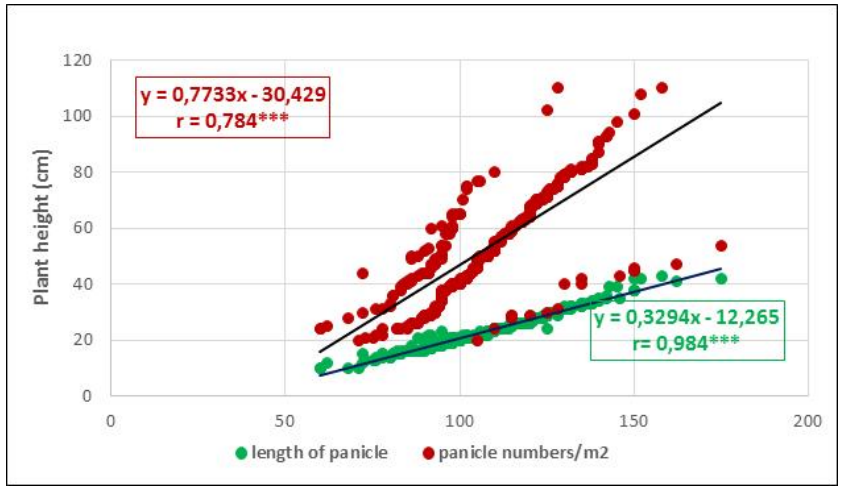

Figure 7 - Regression lines betweens plant height and length of panicle and panicle number/m^2 of the *Avena* accessions analyzed in the experimental field

Regarding the other two descriptors (panicle length and number of panicles/m^2), it can be observed that there is a very large variation amplitude within populations and standards (20-110 panicles/m^2 and 10-43 cm, panicle length) (*Fig. 6*).

In *Fig. 7* it is noticed very significant positive correlations between the plant height and the number of panicles/m^2 and between the plant height and the length of the panicle.

Productivity, seed weight and test weight

For the three agronomic traits we determined variation amplitude and average (*Table 1*). The biggest variation amplitude it is noticed in the local population for productivity and seed weight, and in wild relatives for test weight, and the smallest variation amplitude it is noticed in the standards for productivity, in wilde relatives for seed weight and in the local populations for test weight.

Table 1 - The dispersion indexes on the *Avena* accession for the agronomic traits

Character	Biological status	Min. value	Origin	Max. value	Origin	Variation amplitude	Average
Productivity (g/m^2)	Local pop.	22,6	Bulgaria	1250	French	1227,4	332,86
	Obsolete cultiv.	74	French	737	Poland	663	377,33
	Standard	55	Germany	327	Poland	272	198,33
	Wild relatives	60	Germany	750	Czech Rep	690	360,41
Seed weight (g)	Local pop.	6,9	Germany	39,9	Poland	33	25,64
	Obsolete cultiv.	19,1	Germany	35,1	Poland	16	26.58
	Standard	19	Germany	36,1	Germany	17,1	27,75
	Wild relatives	20,6	Germany	32,8	Germany	12,2	26,67
Test weight (kg/hl)	Local pop.	29,3	England	58,7	Poland	9.4	35,9
	Obsolete cultiv.	31,3	Poland	42,7	Poland	11,4	35,91
	Standard	29,8	Germany	50,8	Germany	21	37,77
	Wild relatives	33,8	Germany	58,3	Poland	24,5	40,31

REFERENCES

Bulinska-Radomska, R. ***et al.*** **(2010).** Nutritional quality in oat genetic resources - a european initiative (AVEQ). *European Oat Conference: More Oats*, 1-3 Sept., 2010, Ystad, Sweden.

Germeier C.U. ***et al.*** **(2012).** Screening of oat germplasm: results from the European Project "Avena Genetic Resources for Quality in Human Consumption" (AVEQ). *Ninth International Oat Conference, Beijing, China,* 20-23 June, 2012.

Meyer, D. & Zwingelberg, H. (1996). *Verarbeitungseigenschaften von*

inländischen Hafersorten. Getreide, Mehl und Brot., 50: 333-337.

Murariu, Danela *et al.* (2013). Charectistics of relevance for quality analyses in European Avena Genetic Resources collections. *Romanian Agricultural Research*, 30.

Plăcintă, Domnica, Daniela (2007). Micromicete ce se transmit prin semințele de cereale păioase - prevenire și combatere (Micromycetes that are transmitted through grain cereal seeds - prevention and control). *Edit. Univ. Suceava*.

Saastamoinen, M. *et al.* (2004). ß-Glucan contents of groats of different oat cultivars in official variety, in organic cultivation, and in nitrogen fertilization trials in Finland. *Agric. Food Sci.,* 13(1-2): 68-79. DOI https://doi.org/10.2137/12390990418 38076

* The Food and Drug Administration (1997). Food labelling: health claims, oats and coronary heart disease. Final rule. *Federal Register*, 62: 3583.

** **IBPGR (1985)**. International Board for Plant Genetic Resources, *Oat Descriptors*, Rome, 1985.