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**UNIVERSITY OF AGRICULTURAL  
SCIENCE AND VETERINARY MEDICINE  
„ION IONESCU DE LA BRAD” IASI**

SCIENTIFIC FIELD - AGRONOMY

**HABILITATION THESIS**

RESEARCH CONCERNING GENETIC  
VARIABILITY OF *AVENA* AND *ZEA MAYS*  
GERMPLASM *EX SITU* CONSERVED IN  
SUCEAVA GENE BANK

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## ABSTRACT

Conservation of plant diversity is important because of both the direct benefits to humanity that result from its exploitation in breeding of agricultural and horticultural plants and the high potential for the emergence of new pharmaceuticals, cosmetics, etc. as well as in the functioning of all natural ecosystems.

In formulating of strategies for conservation of any species, it is essential to know the geographical distribution areas and to identify the regions in which the collection of plants is useful for the conservation of that species.

Agriculture has progressed with the beginning of scientific improvement of plants, when modern varieties gradually took the place of local populations. This phenomenon has led to the *ex situ* conservation of old cultivations, forming valuable collections in gene banks around the world.

By the morphological, physiological, biochemical and molecular characterization of these cultivars conserved in Gene Banks, it is made available to breeders an initial breeding material with well-known properties, resulting in a diminutio of breeding cycles and obtaining of modern varieties with resistance to biotic and abiotic stress factors and higher quality.

This is the argument underlying the researche that I have carried out and which are presented together with results of my professional evolution, scientific and academic career, in the habilitation thesis entitled: Research concerning genetic variability of *Avena* and *Zea mays* germplasm *ex situ* conserved in Suceava Genebank

The thesis is structured according to the legislation in force and the regulation of the USAMV, regarding the organization and

the process of obtaining the certificate of entitlement to acquire the quality of doctoral supervisor, in four sections, respectively: **A. Abstract; B1. Scientific and professional achievements; B2. The plan of evolution and development of the scientific career; B3. Bibliographic references**

The selected results for highlighting my scientific career, after obtaining the title of PhD in agronomy - 1994, are presented in B1 section, in chronological order, differentiated by three research directions and documented by references to articles that I have published between 2009 - 2019. The results are presented in the context of the current state of scientific research in the field of conservation and characterization of plant genetic resources, highlighting their own achievements and their relevance in the field of genetic diversity and erosion of the analyzed germplasm.

The three research lines that I have carried out are:

- **Genetic variability of Avena genetic resources;**
- **Field and laboratory screening of local maize germplasm;**
- **Genetic erosion of autochthone maize local landraces.**

Each research line has the following structure: introduction; research material and method; results and discussions; conclusions. The thesis includes 5 photos, 20 figures and 29 tables, which come from scientific articles published in extenso, which I have published in ISI journals with impact factor and in BDI indexed journals. The results of the researches that I have carried out, are briefly presented, in that three research lines, as follows:

**1. Genetic variability of Avena genetic resources;**

In the first research line of research I presented the most important results regarding the genetic variability of Avena

germplasm conserved at Suceava Gene Bank. Oat is a favorable crop for sustainable agriculture, being a cereal that does not require special production costs. It is also suitable for organic farming, obtaining high yields, comparable to those obtained in intensive agriculture.

Starting from the idea that this crop should be reconsidered as a cereal used in human consumption, and in the Romanian literature there is no research on the quality of oat grains and their use in food, the studies carried out within the European project "Avena genetic resources for quality in human consumption" gave me the opportunity to analyze the Avena collection conserved at the Suceava Gene Bank, and from the perspective of using these resources to create oat advanced cultivars used in human consumption. The main purpose of these researches was to characterize and evaluate the oat accessions from the European collection, for different traits, which are important for knowing the quality of the oats, for use in human consumption. Field screening of genetic material was performed using morphological and agronomic descriptors. I noted a great variability of the analyzed traits, with certain genotypes being highlighted, as important sources for oats breeding.

Along with the primary characterization, in the own experimental field, studies were conducted on the behavior of European oat germplasm in four locations in Europe (Estonia, Italy, Bulgaria and Romania), which highlighted the high variability of the agronomic parameters, to the local populations compared to the standards or the advanced cultivars. There were also large differences in productivity as a result of the genotype x

environment interaction. The highest productivity values were obtained in modern varieties, followed by the obsolete cultivars.

Another area, achieved in this research direction was the testing of frost resistance in field, of oat genotypes in Suceava conditions, allowing the identification of sources of frost resistance, which can be used by breeders, in obtaining of varieties of winter oats in Romania too.

## **2. Field and laboratory screening of local maize germplasm;**

In the second research line I presented the results regarding the genetic variability of the Romanian maize local landraces. Important results on the genetic variability of local maize populations were obtained within a national project entitled "Increasing the efficiency of using an important local maize gene pool in Romania". The Suceava Gene Bank holds a rich collection of local maize landraces consisting of 3587 samples, collected from the mountain and sub-mountain areas of our country. Within this project, 300 samples were characterized from morpho-physiological and agronomic point of view, belonging to the local landraces, coming from different areas of Romania. From the 300 accessions with very good resistance to low temperatures were chosen the genotypes very resistant to low temperatures. These determination was performed in the laboratory conditions (Debbert method). Thus, 61 local landraces were identified very resistant to low temperatures. These accessions were also tested in terms of resistance to Fusarium. At the end, 10 local maize landraces have been selected, which have high values of the productivity components, and are very resistant to low temperatures, have good agronomic stability and can be considered as potential

sources of maize breeding from the wet and cold areas of Romania.

Another topic presented in this chapter, it was the evaluation of the cold resistance, under laboratory conditions of 10 maize genotypes, highlighting the significant correlations between the amino acid content of kernels (methionine, serine, threonine, arginine) and the high resistance to low temperatures of maize genotypes. Also in this section were presented the results regarding the molecular characterization of 61 local maize populations, representing a first approach to the evaluation of the genetic diversity of these local populations, originating from the western part of Romania.

The use of molecular markers besides the study of genetic diversity and the investigation of the genetic relationships between them, revealing a wide genetic variability within the characterized populations, which could be used as prebreeding material in the breeding maize programs.

### **3. *Genetic erosion of autochthone maize local landraces.***

In the third research line I presented a study on the genetic erosion of the local maize landraces, which were kept in the peasant farms in Bucovina, more specifically in the localities of Broșteni, Frumosu, Vatra Molodoviței and Vama, for 32 years. By analyzing the two breeds kept on the farm, it was observed that the traits of both forms have changed strongly, defending the danger that they will disappear in the more or less distant future.

These studies allowed me to make a complete documentation of oat and maize genetic resources, conserved in Suceava Genebank, having a positive impact on the use by breeders, both of information and of germplasm, for the creation of

new varieties or hybrids with a broader genetic basis and good ecological plasticity, adapted to the environmental conditions of each crop area.

**In B2. section – Development plans and career evolution** are presented the main results obtained in professional and academic plan, namely: the publication in the last three years, of three books in national publishers, of which two, as first author; manager, project responsible or member in 16 international or national research projects; obtaining two ASAS awards ("Constantin Sandu Aldea"), for the books: "Oat"- 2017 and "Wild relatives of cultivated plants in Romania"- 2018, and of the award of excellence granted by the European Foundation "Research Support Scheme" in Czech Republic for the results obtained in the international project "*Inventory of the Local Maize Landraces in the Carpathian Mountains*" (2000-2002); the acquisition from the project funds: "*Increasing the efficiency of using an important local maize germplasm fund in Romania - UEFSCDI*" and "*Avena genetic resources for quality in human consumption - EU*", of equipments for plants genetic resources, characterization & evaluation laboratory, of Suceava Gene Bank, collaborating with researchers of other similar institutions from Europe.

**In B2.2. section - Development plans and career evolution in scientific plan,** I presented the future objectives that will be reflected by the publication of new scientific books, the approach of new research directions and a better interaction with students from the University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" of Iasi.