# ABSTRACT
## of doctoral thesis

**„Study of variability in some hybrid populations of french bean (*Phaseolus vulgaris* L.)",** elaborated by Daniela Țigăieru (Trifan), under the coordination of PhD, Prof. Constantin Leonte, at „Ion Ionescu de la Brad" University of Agricultural Sciences and Veterinary Medicine, Iaşi, Horticultural Faculty.

The paper has 222 pages and is structured into eight chapters:

- Chapter 1 - General appreciation about garden beans culture
- Chapter 2 - Genetics of Phaseolus vulgaris L. Species
- Chapter 3 - The natural conditions in the research area
- Chapter 4 - Characterization of materials and methods of research
- Chapter 5 - Study agrobiologic collection of original material for hybridization
- Chapter 6 - Hybridization
- Chapter 7 - Study of hybrids derived
- Chapter 8 - General conclusions and recommendations

The references includes 267 titles cited in the thesis. The paper contains 40 tables and 104 figures and graphs.

First part, composed of the first two chapters represent a synthesis synthesis of the researches made at *Phaseolus vulgaris* L. species, in the country and outside of it, regarding to morpho-phisiological biochemical and cytogenetically characterization.

Second part of thesis includes six chapters, which presents the natural conditions in the research area, characterization of materials and methods of research and own research results made during the doctoral work.

Garden beans cultivation occupies an important place in the Romanian agriculture, both for high protein content, amino acids and vitamins for a balanced diet and that is a good run, before releasing the land and leaving a loose soil, clear of weeds and enriched with nitrogen (about 70 kg/ha).

This is a good reason for increased interest in terms of culture legumes in sustainable systems, including ecological, biological or organic, a study determined the need for breeding of this species in order creation of new varieties and hybrids resistant to biotic factors and a biotic stress.

Researches conducted at Research Institute for Horticulture Vidra and especially those of Vegetables Research Station from Bacău, during 1984-1987, have enriched the assortment of garden bean varieties with increased resistance to some disease-specific species, but the problem resistance to pests and drought still remained unresolved.

In current circumstances in Romania and the universal tendency to promote organic cultivation, the proposed acquisition of hybrids with improved resistance to pest attack and drought at a value as scientific and practical interest, being an objective necessity for the completion of knowledge, but also practicing performance horticulture.

Given the above conditions and with the technical trial of the University "Low Danube" from Galati and SCDA from Braila, and appropriateness of preparing the doctorate in the Faculty of Agriculture in Iasi U.S.AMV, these researches were made to breeding the french bean germoplasm, in order to increase production, quantitatively and qualitatively, in our country conditions. To this end, it made a series of targets by which to determine the influence of factors environment on the crop and how knowledge of segregation of characters in the progeny, in order to use the hybrids produced in manufacturing and as germoplasm the source of the future improvement.

The first chapter refers to the importance, origin and range of the culture of garden bean, and the particularities of biological, ecological and technological relations with environmental factors. Due to high content of protein, amino acids and vitamins, beans garden occupies an important place in the agriculture of many countries, being ranked in the top 10 major crops in the world with an output of over 8 million tones per year and an area of cultivation approximately 13 million hectares. The agrotechnical importance of garden beans derives from the fact that it is a good run, leaving a loose soil, clear of weeds, enriched with nitrogen and releasing land early.

The origin of common beans (*Phaseolus vulgaris L.*) is in an ancestral species *P. aborigenus* originating in Brazil and Argentina with other three species (*P. coccineus, P. acutifolius and P. lunatus*). By taking in culture, approximately 7600 years BC in Peru, was born *P. vulgaris* cultivated species, which migrates around 7000 years BC in Mexico (Tehuacan), where it's develops a second center of diversity (LL Hardman et al. , 1990). Thus, by taking into culture, beans from South America is evolving into a form with high beans and one in Mexico to another with little beans.

In Romania, the beans are grown from the earliest eighteenth century, the most favorable being the south, southeast and southwest, in the fields and meadows of the most important rivers.

According to FAO in 2008, now the species *Phaseolus vulgaris L*. is grown on about 12 – 13 thousands ha, with a total production of 42 - 50 thousands tones. From the resulting importance of food culture, agrotechnics, economics and social main risk factors. Beans garden grow mainly for its shell that is consumed only cooked (canned or raw) and immature seeds in salads or as mature grains in different foods or milk extraction plant.

Particulars biological reference is essential to main-anatomical morphological characteristics, and to some peculiarities of growth and development. Beans garden is an annual plant, grass, climbed the east epigeic with the vegetation period of 120-140 days, is self-pollination and fruit is a legume that is consumed in technological maturity ("green") or can be consumed as immature grains (technological maturity - in raw salads) or as mature grains (physiological maturity - in various cooked dishes). It must show that beans from the garden presents the advantage of using both products in the form of pasta, and as immature grains and / or mature.

Ecological particularities out highlights rusticity and ecological plasticity of this plant, but underlines the high temperature side (warm fill plant) and susceptibility to drought during blossom and fructify periods. Due to this reason, we considered it necessary to study various germoplasm bean garden and selection of resistant local populations, followed by hybridization with the approved varieties, in order to achieve productive hybrids in drought conditions.

Second chapter includes genetic species *Phaseolus vulgaris L.*, with the latest discoveries related to phenotypic characters morpho-physiological and productive quantitative and qualitative floral biology and methods of hybridization, 6 containing references to the breeding of this species.

Chapter three is dedicated to presenting the natural conditions in which investigations were completed. Characterization of soil and Agricultural highlights of bean plants that are very favorable conditions for cultivation in Brăila plain: soil is a mold vermouth carbonate in Tichileşti zone and aluviosol limestone in the area Vădeni in field conditions, moderate leachate well supplied with nutrients. Weather and climatic conditions reveals that beans garden finds favorable conditions for cultivation, but only in ensuring an intake of additional water through irrigation. In short, the climatic conditions are typical of a temperate continental climate with hot summers and harsh winters. Multi-annual average temperature is 10-11° C with medium to large variations from one year to another, and monthly values for decades.

Chapter four aims to show information about the characteristics of biological material originally used methods of investigation and characterization of weather conditions during testing. As biological material originally used an assortment of 42 local populations of the

garden bean varieties and 6 approved as part of a study collection standard. The results have highlighted the great diversity of morphological and physiological study of the range was noted in terms of productive capacity in terms of biotic and biotic stress four varieties approved three local populations.

These differ from cultivation through distinct characteristics: Carson - belated variety dwarf beans with round pods, and average length of 13 – 15 cm, golden, thread free, productive, Jutta - dwarf variety of beans, with the vegetation period of 83 days, height 41 – 45 cm, round shell, green, medium length 11 – 13 cm; Inka - variety of beans to grains with height 35 – 45 cm, 13 cm paste with 5 - 6 medium grain, beige with brown spots; Lingua di Fuoco - early variety of dwarf beans with height 30 – 45 cm, straight shell, cream with red spots and stripes, round grains - oblong; Vădeni - local population collected from Vădeni, Braila county, with indeterminate growth, height plant 210 cm, yellow pods, length 14 - 16cm and 5 - 6 in grain legume; Tichileşti - local population beans growing indefinitely, collected in the area Tichileşti, Braila county, with green pods, late, long 16 – 18 cm; Movila Miresii - local beans population growing indefinitely, collected from Movila Miresii, Braila county, with yellow pods, late, with a length of 20 cm. Also in Chapter four were described methods of research, how to do field collection, in the greenhouse, observations of the vegetation, methods of laboratory analysis and characterization of weather conditions during the research, is putting particular emphasis on the years 2007 - 2008, when the culture was produced hybrids in the field, as a field selection. Technology has been growing organic without phyto-sanitary treatments or fertilizer minerals, to see production capacity in terms of a biotic and biotic stress, both in greenhouse and field conditions.

Chapter five examines the practical study of the material originally agrobiologic for hybridization and the choice of parental genitors. Variants have been described and experimental location experiences, observations, measurements and laboratory tests performed and the results achieved in the years 2005 to 2006. Of material collected, have experienced the following genotypes: approved varieties: Carson, Jutta, Inka, Narbonne, Unidor, Lingua di Fuoco and local populations: Vădeni, Oancea, Salt-Lake, Tichileşti, Gropeni, Chiscani, Baldovineşti, Movila-Miresii . For each genotype studied phenotypic variability of the main quantitative characters, and other physiological and morphological acquisition. For the height of plants - the magnitude of variation was between 223 ± 3 cm in population Tichileşti and 31 ± 2 cm in Narbonne variety, which indicates that stalk height is great variability in populations of garden bean studied.

The amplitude variation of branches per plant were between 3.1 for Lingua di Fuoco variety and 7.4 for Movila Miresii population, and height of insertion of the first pod was a variation of amplitude between 10 ± 1 cm to the variety Jutta and 26 ± 2.3 cm Vădeni

population. The total number of pod per plant is an important for productivity, which in experience compared to an amplitude variation of very large, being between 20 ± 6 pod per plant - the variety Carson and 6 ± 3 pod per plant - Jutta the variety, and the average number of grains in the pod were observed populations from Movila Miresii, Salt-Lake followed by Jutta variety. All these results, in conjunction with certain conditions to be met by genitors for hibridation (coincidence at blossoming, the growing presence of distinct characters, etc.) led to the election next genitors: Carson, Jutta, Inka, Lingua di Fuoco, Vădeni, Tichileşti, Movila Miresii.

Chapter six contains a description of how the hybridization was performed with placement experience in the greenhouse, stages of hybridation, completion and results. Hybridization was a diallel type to perform capacity analysis of general and specific combination ability. In this chapter is presented the chart of incomplete diallel hybridation, with 10 hybrids obtained, which were marked from H1 to H10.

In Chapter seven were studied hybrids derived for the morpho-physiological compared with genitors and analysis capability indices productive combination, and correlations between characters for each hybrid production lines. Genetic variability indices, see the analysis of each production followed have been taken in a series of mathematical analysis, which allowed the record of GCC and CCS, and reciprocal effects for all characters quantitative and qualitative production of hybrids pursued.

Results on the general ability of various combinations of bean genotypes garden productive quantitative indices to track showed the highest values of pod number per plant (2.4) in Inka variety and number of beans in the shell (0.8) and shell length (3.3) to the local population Movila Miresii. Results concerning to GCC genotypes studied for clues productive quality watch showed the highest values for protein content in the pod (0.15) the variety approved Lingua di Fuoco and for protein content in grain (1.33) the variety Jutta approved.

In regard to specific combination, the study results revealed a maximum effect by CCS for the quantitative production of hybrid combination Lingua di Fuoco x Jutta (4.25 for number pod per plant and 1.34 for number seeds per pod) production and quality (crude protein content in pod and seeds) the best results for CCS was obtained from the hybrid combination Inka x Carson (0.32 - CCS protein content of pods and 1.05 - CCS for protein content of seeds).

Were also studied the variation of parameters morpho-phisiological, namely: plant height, pod length, biomass accumulation, the braches per plant and the total number of pod per plant. The accumulation of green and dry biomass is used to determine the level of somatic heterosis, in growth intensive vegetative parts, which is a very important parameter in increasing plant productivity. The study compared the content of green biomass and dry in the ten hybrids,

demonstrated that hybrid H1 are characterized by the maximum of the green biomass (23.80 g and 24.5 g F1 to F2), and the dry (4.27 g and 4.21 g F1 to F2).

Summary of correlations showed that the production plant is positively correlated with pod number per plant, but is not correlated with shell length. As a result, increase productivity, be selected forms pods more. The coefficient of correlation between shell length and number of pod per plant was - 0.15 for F1 and - 0.12 for F2, indicating a negative correlation between these characters. Meanwhile, there was a positive correlation between the number of ramifications of the plant and the total number of pod per plant, with a coefficient r = + 0.66, so the selection process will be chosen form the ramifications.

Between plant height and number of pod per plant and between plant height and number of ramifications of the plants were produced negative correlations with a correlation coefficient of r = - 0.13 and r = - 0.35 in F1 values these coefficients are negative preserving and F2 (r = - 0.01 and r = - 0.07). This indicates that the valuable forms of the production are those with low waist and high offset. The most valuable hybrids, in this regard were: Lingua di Fuoco♀ x Carson ♂, with an average height of 37 ± 2 cm, the maximum number of ramifications (5) and an average number of 35 ± 2 pods per plant , Movila Miresii ♀ x Carson ♂, with an average height of 49 ± 3 cm, five ramifications and 29 ± 2 pods per plant, followed in descending order by hybrids Inka ♀ x Vădeni ♂, Inka ♀ x Carson ♂, and Inka ♀ x Jutta ♂.

Regression study of hybrids in F1 and F2 for the number of beans in the shell showed that the F1 generation, all hybrids showed heterozis against the father, while from the mother showed heterozis only 3 hybrids, namely: H7 (Inka ♀ x Vădeni♂ with heterozisului value 11.4%), followed in descending order of H5 (Lingua di Fuoco ♀ x Jutta ♂, with 7.3%) and H9 (Tichileşti Carson ♀ x ♂, with 6.5% ) and in F2 generation hybrids all had lower values for the number of beans in the shell, compared with the average parental genotypes.

In the correlations between characters within each productive hybrid has been found that the production plant has the highest values in hybrid H1 (Inka ♀ x Carson ♂) in the F1 generation hybrid and H4 (Lingua di Fuoco ♀ x Carson ♂) in F2 generation.

Chapter eight contains general conclusions with recommendations. Studies on the analysis of genetic material that has proven productive character variability is due mostly genetic particularities. Experience shows that made the new genotypes created corresponding cultivation in arid areas, with a good adaptation to local conditions as high perspective, by providing valuable products, both in the quantity of pods and / or seeds, and by the quality of the harvest.