

SUMMARY

Key words: runner bean, local population, biodiversity, agro-productivity, variability.

The scarlet or runner bean (*Phaseolus coccineus* L.) is a well known species in our country, but it occupies relatively small areas, it can be seen especially in the gardens of the people from the rural area. The plant is being cultivated especially for its beans, dried or green, the forms from which the pods are used being less known.

The species comes from South America, being brought together with the kidney bean (*Phaseolus vulgaris* L.), without any clear distinction between the two species. In Europe a culture from the XVII-th–XVIII-th centuries is known and in our country one from the XVIII-th–XIX-th centuries (Stan și colab., 2003). In our country, the climbing forms are known, especially.

The scarlet or runner bean found good conditions for growth, fact proven by its large spread in all regions of the country, having both nutritional and ornamental usage. However, the species has not become of great economical importance in the culture, probably because of the lower economical efficiency and also because of other several factors listed below: low amenity for climbing forms of beans, less suitable for mechanization, the lack of an improved type (due to the fact that exclusively local populations were being cultivated), fluctuant productions from one year to another (depending on the weather), the lack of a modern and/or standardized growth technology etc.

The lack of organized scientifically knowledge about the biology and ecology of the species under the specific circumstances of our country was also an element that contributed to the “slower” progress of this species.

The anterior studies (Munteanu, 2006; Popa și colab., 2006; Munteanu și colab., 2007; Popa și colab., 2007) stressed the great diversity of the existing populations in the collection of the University of Agriculture and Veterinary Medicine, Iasi, morphologically, physiologically and agro-productive.

There can also be observed the high degree of rusticity and ecological plasticity compared to the kidney bean, due to the endurance or tolerance towards the pathogen agents.

Of great importance is the fact that this rusticity confers it a high degree of suitability to the sustainable agricultural system, including organical/biological/ecological systems. Actually, this suitability is proven also by the great diversity of this species, highlighted by the great number of existing local populations.

Our researches focused on the morphological and phenological particularities of the assortment existing in collection, the evaluation of the production capacity of some local valuable populations, the elaboration of some diagrams and optimal culture densities as well as the elaboration of some diagrams of protective selection and obtaining the basic seed.

The present thesis is structured into two parts and has nine chapters:

- I-st part – The current knowledge regarding the runner bean (*Phaseolus coccineus* L.). This part includes the following chapters:
 - I-st chapter – Origin, taxonomy, spreading area and importance of the *Phaseolus* genus and the *Phaseolus coccineus* L. species (runner bean);
 - II-nd chapter – Theoretical and practical knowledge related to the agrobiological and cultivation technology for the runner bean.
- II-nd part – Results of the own studies and researches. This part includes the following seven chapters:
 - III-rd chapter – Goal, objectives, biological material and general research methodology;
 - IV-th chapter – Study of the natural environment and technical-organizational conditions on “V. Adamachi” Farm of U.A.S.V.M. Iasi;
 - V-th chapter – Researches related to the biological and ecological particularities of runner bean (*Phaseolus coccineus* L.);
 - VI-th chapter – Study of the agro-productive capacity of the analyzed assortment;
 - VII-th chapter – Research to optimization of some technological factors of runner bean crop;
 - VIII-th chapter – Researches regarding the variability of certain quantitative characters in the conservative selection and obtaining the basic seed at runner bean;
 - IX-th chapter – General conclusions.

The bibliography comprises 115 titles of specialized works from the country and abroad.

The first chapter focuses on the importance, origin and habitat of runner bean. This species is grown especially for its unripe seeds or “beans”, as well as for its dried seed. The nutritional importance is shown by the protein content (20%), carbohydrates content (63%), mineral salts, fibers and vitamins content.

Under favorable growing conditions, big enough productions can be obtained in order to ensure an adequate economic efficiency. The climbing forms can achieve productions of 40-50 tones/hectare and the uniped forms of 10-12 tones/hectare.

The origin centre of the runner bean is in Mexico and Central America, being cultivated during the period 9000-7000 B.C. It was brought into Europe probably in the XVI-th century, but the first mentions about this species appear in the Gerard's study "Herball" (1633), being described as an ornamental plant.

The runner bean can be found almost in all the areas where the kidney bean can be found. Countries with a tradition in the growth of scarlet bean, especially in a single culture system, are: the Netherlands, Belgium, Spain, France etc. In Romania *P. coccineus* is widely spread in all the agricultural areas, plane, hill or submontane regions, but on small areas in family farms. In the north-eastern part of Romania it can be found in the plane regions from the districts Galați or Botoșani, in the hilly regions from the districts Bacău, Vaslui, Neamț or Iași, but also in the submontane or montane depressions from the districts Bacău, Neamț and Suceava.

The II-nd chapter is dedicated to presenting the biological, ecological and technological features of the scarlet runner culture.

The biological features refer especially to the anatomical and morphological features, highlighting certain characteristics.

The scarlet runner is a herbaceous yearly plant, although at origin it looks as a perennial plant, with a vegetation period of 120-125 days; the pollination is alogam and the emergence is hypogeic, unlike the kidney bean.

The ecological features show us the rusticity and the ecological plasticity of this species, presenting though a sensitivity to the atmospheric humidity, especially during the forming of flowers and pods.

The growing technology of the species *P. coccineus* is presented in several growing systems, depending on the area, possibilities, traditions etc.

Chapter III is dedicated to the presentation of the goal, objectives, material and general methods used.

The goal of this thesis is to improve the knowledge in terms of the biological and ecologic particularities of the species *Phaseolus coccineus* L., so as to substantiate and elaborate some efficient cultivation technologies in Moldova.

To attain this objective, we proposed the following major objectives:

1. The study of the environmental and technical-organizational conditions where researches will take place;
2. The study of the main morpho-physiological characteristics of some local populations of runner bean;
3. The study of the agro-productive capacity of some local populations of runner bean;

4. Effectuation of studies and researches to optimize the technology for the cultivation of the runner bean;
5. The study of variability of some quantitative characters for the elaboration of some adequate diagrams of preservative selection and obtaining the basic seed.

In chapter IV, we present a study of the natural and technical-organizational conditions where the researches took place. The pedological and agro-chemical characterization showed us that the runner bean finds favorable conditions to be cultivated in the conditions from Iasi. The soil is a cambic medium levigated black carth, well supplied with nutrients. The climatic and weather conditions are suitable for the growth of this species, but with additional watering. Concisely, the climatic conditions are typical of a mild continental climate, with hot summers and cold winters. The average yearly temperature is of 9.6°C, with fluctuations from one year to another, meanwhile, the sum of average yearly precipitations is 517.8 mm.

From the agro-meteorological viewpoint, the experimental period was quite favorable to the runner bean culture, except 2007 which was extremely warm and droughty.

Chapter V has as its main objective the presentation of the results obtained in terms of the morphology and ecology of the species *P. coccineus* L. As biological material, we used an assortment of 26 local populations from the collection of the subject Vegetable growing. The collection has two cultivars from the Great Britain and 24 local populations from the counties: Galați, Bacău, Vrancea, Vaslui, Iași, Neamț, Suceava, Botoșani and Brăila. At the same time, the assortment comes from diverse ecologic areas: field, hill and mountainous areas.

The results obtained highlighted the great morphological diversity of the assortment under study. The character confirming most obviously the distinctibility is the colour of seeds. Thus, biodiversity was shown by the presence of seeds of different colours and sizes. These are unicolor (white) or bicolor, with a violet background and an arabesque-like pattern of black or dark violet colour or with a beige background and a brown arabesque pattern.

Chapter VI focused on the study of the yield capacity for an assortment of ten local populations from the collection of U.A.S.V.M. Iasi. To attain our goal, we relied on the following objectives: knowledge of the main elements of productivity for an assortment from the collection; appreciation of the production rate for a series of comparative cultures organized in relation with the annual conditions.

The productivity of the assortment under study was appreciated by cumulating numerous elements, namely: number of seeds per plant, pod size, seed size, number of seeds in the pod, mass of 1000 beans (MMB), and estimated seed yield a.o.

As for the yield capacity for an assortment of local populations in interaction with the environment condition, following the analysis and statistic processing of the obtained results, we

noticed population *Coccineus* 5 as having the highest average multiannual yield (3854 kg/ha); this was closely followed by population *Coccineus* 2 with an average yield of 3755 kg/ha.

As for the combination of the factors cultivar x yield year, we noticed that the highest yield, namely 5620 kg/ha, was obtained by the population *Coccineus* 5 for the yield year 2006.

Chapter VII refers to the research results regarding the influence of some technological factors on the yield of 10 local populations, as well as the manner of their optimization. The biologic material was represented by a number of ten local population based on the collection studies. The experiment was organized in the interval 2006-2008, in the didactic-experimental field of the subject Vegetable growing, in an area of subdivided parcels, corresponding to the experimental factors under study (cultivar, setting up time, density).

The research results were structured in distinct subchapters by presenting both the individual contribution of the technological factors under study and their combined influence.

We demonstrated that the cultivar factor is the most important yield factor and population *Coccineus* 5 stood out in this respect.

The setting up time is another important factor and determines significant differences, the average yields with the highest values being registered for the setting up time 10.05, namely 4216 kg/ha.

The distance between holes on a row also determined significant differences, the 45 cm distance between holes giving the highest average yields (4302 kg/ha).

As for the combination cultivar x setting up time, the best combination was the one between *Coccineus* 5 and setting up time 10.05, with an yield of 5061 kg/ha, and if we take into consideration the combination cultivar x distance between holes on a row, the combination with the best results was the one between *Coccineus* 5 and 45 cm distance, with an yield of 5158 kg/ha.

In chapter VIII, we present the research results in terms of the variability of some quantitative characters in the preservative selection. The analysis was mad comparatively between the species *P. coccineus* and the species *P. vulgaris*. We focused on two characters related to the productive rate of these species: number of pods per plant and the number of seeds per plant.

The results obtained materialized in the comparison of the variability indicators and the variation histograms so as to substantiate the preservative selection works. Thus, though the variation limits, the arithmetical average and the standard deviation are higher for *P. vulgaris* as compared to *P. coccineus*, the synthetic indicator related to variability shows that the highest variability for the character “number of pods per plant” is registered by population C₂₃, namely $s\% = 25.4$ as compared to $s\% = 23.16$ for the species *Auria Bacăului*.

As for the character “number of seeds per plant”, we may notice that the value of the variability coefficient is higher (29.73%) for *P. coccineus*, as compared to *P. vulgaris* (27.15%), due to the particularities of floral biology of the runner bean (allogamous plant).

The histograms and variation curves of the two characters highlight the fact that the populations of the cultivars under study are homogenous, balanced and stable.

In the last chapter, we present the general conclusions of this thesis, the objectives established being completely attained. Thus, we outlined some technical solutions according to which the factors under study may be optimized. Recommendations for research and yield are clear, in accordance with the best variants shown by the results of this thesis.

As a conclusion, following the research activities carried out during the 3 year experimental period, we may surely affirm that the species *Phaseolus coccineus* L. is a species deserving more attention from the specialists' part.