



Opinion

Volume 26 Issue 2 - September 2021
DOI: 10.19080/ARTOAJ.2021.26.556330

Agri Res & Tech: Open Access J

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Creation of New Lupin's Forms with Economically Useful Traits

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Submission: September 03, 2021; **Published:** September 07, 2021

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Opinion

Research materials were represented by the lupin collection of the Vavilov Institute of Plant Genetic Resources (VIR) storing now more than 2500 accessions of different lupin species collected by numerous expeditions over the globe and material from the All-Russian Institute of lupin. We have used the special methodology of the Vavilov Institute developed concerning lupin [1]. The same set of accessions was studied in different climatic zones of Russia, Ukraine, Georgia, and Finland using the same method. The theoretical basis for our research activities was N.I. Vavilov's works on plant genetic resources: the doctrine about the species as a system, the law of homological series in hereditary variation, differential systematic and geographical method of crop studies, etc. [2,3]. Many years of observing plants sown in various regions of many countries have enabled us to find out new regularities in the variability of characters depending on genetic features of the species and accessions, and on ecological and agronomic conditions of their growth. Geographic plantings and plant genetic resources study in different environments by uniform methods organized by NI Vavilov appeared extremely fruitful. They allowed obtaining valuable materials by hybridization between forms with different variability of characters in different conditions, which often proved the non-allelic nature of the genes controlling them, and consequently to produce transgressive forms. The nature of the variability of characters changes almost identically in most accessions when they are cultivated under different conditions. However, there are also samples of the character of variability in which is different in contrasting conditions (different geographic locations, soils, or different years of study). It is very important to identify such accessions and use them in further research. Studies have shown that when such accessions are crossed with each other, forms with new traits can appear in the hybrid generation, often useful or harmful for breeding. The hybrid progeny may contain transgressive forms, i.e., the forms with an increased or

decreased value of the character when crossing parents with different types of variability. Differentiation in the variability of characters at parental forms can be found by testing them under different conditions and using the same techniques. It is possible to obtain valuable transgressive forms with the help of this method concerning any characters (high seed yield, chemical structure, disease resistance and others). Our approach makes the process of obtaining transgresses more controlled and effective. The positive results of increasing resistance to *Fusarium* wilt in lupin accessions were presented as an example in our previous work [4]. We have crossed samples with different variability of resistance in different test sites. As a result, two transgressive forms with increased resistance to *Fusarium* wilt were found suitable for the breeding program on *Fusarium* resistance in Russia, and Ukraine. These results served as an incentive for further research, because of which new forms with valuable traits were created:

- a) Forms of yellow lupin (*L. luteus* L.) with high protein content in mature seed (45 % and higher) were obtained by crossing cv. *Borluta* from Germany and k-1556 from Morocco.
- b) Accessions of white lupin (*L. albus* L.) with high protein content in mature seed (45 % and higher) were obtained by crossing k-298 from Palestine and k - 1538 from Poland.
- c) Accessions of *L. albus* with increased content of methionine (higher than 0.58 % to protein), by crossing k - 495 from Ethiopia and k - 828 from Germany.
- d) Sources of high seed yield at white lupin (seed mass per plant 20.0 – 26.1 g), by crossing k - 2004 from Morocco and k-2521 from Portugal.
- e) Forms belonging to the early group (101-115 days) were obtained by crossing cultivars *Start* from Russia and *Tel Karam* (k - 290) from Palestine.

f) Accessions described by increasing nitrogenase activity under artificial processing of Bradyrhizobium sp. (Lupinus) bacteria by interbreeding of cultivars *Snezinka* and *Tambovsky 86* from Russia, k-1601 from Italy, and Leblanc from France.

New commercial cultivars of white lupin have been created at the All-Russian Institute of lupin based on the created by us source material: *Aly Parus* (Scarlet Sail), *Michurinsky*, and *Pilgrim*. Cv. *Aly Parus* has light pink flowers, an average growing season of 120-125 days (under the conditions of the Bryansk region of Russia), the seed yield is 3.8 tons per hectare, the protein content in the seeds is 34.5%. Varieties *Michurinsky* and *Pilgrim* are early ripening (110-113 days), productivity 4.0-5.0 tons per hectare, protein content 36.0 - 36.5%. Lupin is grown on an area of 60 thousand hectares in Russia.

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DOI: [10.19080/ARTOAJ.2021.26.556330](https://doi.org/10.19080/ARTOAJ.2021.26.556330)

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