



Agricultural Institute of Slovenia

# **Breeding prospective of common bean (*Phaseolus vulgaris* L.) for Central and South-Eastern European production area**



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# Common bean

## *(Phaseolus vulgaris L.)*



- ✿ Is one the most important edible food legume for direct human consumption in the world as it represents a valuable source of proteins, carbohydrates, dietary fibre and is a rich source of other components with nutritional and health benefits.
- ✿ For Slovenian production area, common bean is known as a vegetable with increasing level of agronomic interest.
- ✿ In the past, four different varieties of common bean ('Zorin', 'Klemen', 'Jabelski pisanec', 'Jabelski stročnik') were developed at the AIS using individual selection procedure from autochthonous populations.
- ✿ In the last decade, we started with directed cross pollinations of dry bean and recently snap bean.

# Breeding prospective of snap beans (*P. vulgaris* L. subsp. *vulgaris* var. *vulgaris*)



- Tending to develop new „maslenec“ type of varieties-> forms yellow, long, flat and stringless pods,
- early varieties (flowering before high temperatures occur and induce flower shedding),
- resistant / tolerant to biotic stress, particularly viral infections (BCMV), anthracnose (*Colletotrichum lindemuthianum*) and *Pseudomonas savastanoi* pv. *phaseolica*.



# Breeding perspectives of dry beans (*P. vulgaris* L. subsp. *vulgaris* var. *nanus*)



- ✿ High-yielding varieties,
- ✿ resistant / tolerant to biotic stress, particularly viral infections (BCMV), anthracnose (*Colletotrichum lindemuthianum*) and *Pseudomonas savastanoi* pv. *phaseolica*.
- ✿ resistant / tolerant to abiotic (drought) stress,
- ✿ favorably accepted by Central and South-Eastern European producers and consumers.



# Superior parental genotypes of common bean selected for breeding procedure in 2016

Germplasm of maternal lines originated mainly from Central and South-Eastern European geographic area.

The accessions were obtained from the Slovene Plant Gene bank at AIS or from the previous breeding programmes (genotype QTL59) and were evaluated in last years at AIS using *Phaselieu* descriptors.

Only the most perspective genotypes were selected and included as maternal genotypes in hand cross pollination in 2016.

Table 1. Parental genotypes of common bean included in breeding procedure in 2016.

Genotype name	Type	Aim/characteristic
"Parker"	nanus	paternal genotype; Psp+Ant+BCMV resistance
"Nassau"	nanus	paternal genotype; Psp+Ant+BCMV resistance
"Etna"	nanus	paternal genotype; BCMV resistance
"Zorin"	nanus	paternal genotype; Ant resistance (races 23, 55, 103)
SRGB00133	nanus	maternal genotype; Ant resistance (races 23,55,103, 131)
SRGB00412	nanus	maternal genotype; partial Ant resistance
Ribenčan Škoberne	nanus	maternal genotype
SRGB00351	nanus	maternal genotype
SRGB00327	nanus	maternal genotype
QTL59	nanus	maternal genotype; drought tolerance
SRGB00411	nanus	maternal genotype
SRGB00944	nanus	maternal genotype
SRGB00805	nanus	maternal genotype
SRGB00391	nanus	maternal genotype
"Algarve"	vulgaris	paternal genotype; Psp+BCMV resistance
"Cobra"	vulgaris	paternal genotype; Ant+BCMV resistance
"Golden gate"	vulgaris	paternal genotype; BCMV resistance
'Barianec'	vulgaris	maternal genotype
SRGB00660	vulgaris	maternal genotype
SRGB00896	vulgaris	maternal genotype
SRGB00892	vulgaris	maternal genotype
SRGB00203	vulgaris	maternal genotype
SRGB00204	vulgaris	maternal genotype
SRGB00644	vulgaris	maternal genotype
SRGB00060	vulgaris	maternal genotype
Rihar	vulgaris	maternal genotype
SRGB00487	nanus	maternal genotype

For dry beans: **11** perspective maternal and **4** commercial paternal genotypes.

For snap beans: **9** perspective maternal and **3** commercial paternal genotypes.

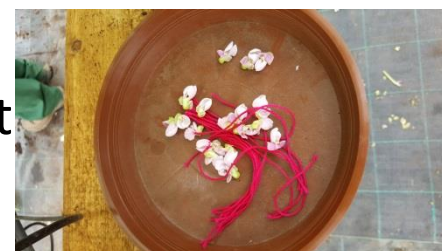
# Parental plants for hand cross pollination

- Seeds of parental plants was exposed thermotherapy (72 hours) at 43°C and chemical disinfection (5 % solution of sodium hypochlorite) before sowing.
- To synchronize flowering period of all included parental genotypes, sowings in four different periods were performed (April 26, May 3, May 10, May 17).
- Only healthy parental plants were included in hand cross pollination (ELISA test on BCMV, BCMNV, BYMV, CMV and AMV + visual observation regarding to Ant. was performed)->ELISA positive and symptomatic plants were eliminated before hand cross pollination was performed.
- The physiologically mature pods were harvested at the end of the August and properly labelled to reflect the general compatibility of parental lines.



# Hand cross pollination

- To develop new varieties with desired traits we performed hand cross pollination of superior parental genotypes as described by Ivančič (2002).
- Cross pollination by hand was done every morning during flowering period of parental genotypes from June until the end of July 2016 in the greenhouse (Jablje).
- Each maternal plant was manually cross pollinated with different paternal genotypes.
- The physiologically mature pods were harvested at the end of the August and properly labelled to reflect the general compatibility of parental lines.



# Results-snap beans

Out of the 27 combinations, in total 130 pods containing 602 F1 seeds (an average of 4-5 seeds in a pod) were obtained.

Table 3: Summary results (average) of hand cross pollination for snap beans in 2016.

Parental genotype	No. of harvested pods	No. of harvested seeds	No. of lost flowers	No. of defected pods	No. of empty pods	No. of harvested seeds per pod
'Cobra'	4.8	20.7	3.6	0.4	0.2	3.9
'Algarve'	5.0	24.6	2.2	0.3	0.2	4.5
'Golden gate'	4.7	21.7	1.0	0.3	0.1	4.9
SRGB00660	2.7	9.7	1.7	0.0	0.0	3.7
SRGB00896	11.7	51.3	3.0	0.0	0.0	4.3
'Barianec'	4.0	13.7	3.7	1.0	0.7	3.9
SRGB00892	3.3	15.7	3.0	0.7	0.0	4.9
SRGB00203	5.0	23.3	2.7	0.0	0.0	4.6
SRGB00204	7.0	38.3	1.3	0.7	0.0	5.5
SRGB00644	3.7	17.0	0.3	0.0	0.0	4.7
SRGB00060	5.3	25.7	1.3	0.0	0.0	5.5
Rihar	0.7	2.7	3.3	0.0	0.0	2.7



# Results-dry beans

Out of 44 combinations performed using hand cross pollination, we obtained a total of 198 pods containing 775 F1 seeds (an average of 3-4 seeds in a pod).

Table 2: Summary results (average) of hand cross pollination for dry beans in 2016.

Parental genotype	No. of harvested pods	No. of harvested seeds	No. of lost flowers	No. of defected pods	No. of empty pods	No. of harvested seeds per pod
'Parker'	5.2	20.0	1.0	0.3	0.9	3.7
'Nassau'	4.7	19.0	1.2	0.7	0.2	3.9
'Etna'	4.1	15.5	1.3	0.5	0.9	3.3
'Zorin'	4.0	15.9	1.6	0.6	0.6	4.0
SRGB00133	1.0	4.5	0.3	0.0	0.0	3.0
SRGB00412	7.8	27.5	1.0	0.0	0.5	4.2
Ribenčan Škoberne	8.3	35.3	2.5	0.8	0.5	4.2
SRGB00351	4.3	12.5	1.5	2.5	1.0	3.4
SRGB00327	5.8	28.8	1.5	0.0	0.0	4.9
QTL59	6.3	25.5	0.3	0.5	0.5	4.1
SRGB00411	1.8	3.8	1.0	0.3	0.3	1.6
SRGB00487	4.3	8.8	2.3	0.3	3.5	4.4
SRGB00944	7.0	28.3	0.5	0.8	0.0	4.2
SRGB00805	1.0	3.3	2.3	0.3	0.0	1.6
SRGB00391	2.3	6.0	0.5	0.5	0.0	2.7

# Conclusion

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- The F1 seeds, obtained from 40 parental dry bean and 26 snap bean crossing combinations, originating from Slovenian and European germplasm represent highly perspective genetic material for further selection and breeding of common bean.
- Varieties with desired characteristics and adapted for cultivation in Central and South-Eastern European production area will be therefore favourably accepted by producers and consumers.

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Thank you for attention 😊

