

HYBRID DEVELOPMENT AND FERTILITY IN
PHASEOLUS VULGARIS x PHASEOLUS COCCINEUS

Liliana Zagorcheva, Ivan Poriazov
"Maritsa" Institute for Vegetable Crops
Bulgaria

In pursuance of the breeding program for development of garden bean cultivars, resistant to diseases, we studied the possibility of transferring the genes for resistance to bacterial and virus diseases from *Ph. coccineus* to *Ph. vulgaris*. The material used was cv. "Amboy" (*Ph. vulgaris*) and PI 165421 (*Ph. coccineus*). The flowers of cv. "Amboy" were emasculated two days before opening. The next day they were pollinated with pollen, taken from the stamens of PI 165421, broken and immersed into 1 % solution of sucrose. The hybridization in January, February and March resulted in the formation of a great number of parthenocarpic pods. Only the hybridization in April resulted in the formation of 18 pods with 2 to 6 seeds each. From the 67 seeds, that were sown, only 29 emerged. The fertility of F₁ was poor. Most of the F₁ plants formed 1-2 pods. There were rarely more than one or two mature seeds per pod. Pollen stainability was about 20 %. Backcrossing with *Ph. vulgaris* resulted in the formation of 4-6 pods per hybrid.

Hybrids in F₁, F₂, F₃ and BC₁, BC₁F₁ were dimorphic with one normal and one abnormal phenotype. The abnormal plants showed dwarfing. Segregation was 9:1 in F₁; 3:1 in F₂; 11:1 in F₃. In BC₁ and BC₁F₁ only some of the combinations were dimorphic. In some of them segregation was 3:1. The hybrids in F₁, F₂ and F₃ had indeterminate, semi-indeterminate and determinate growth habits (table 1)

Table 1

Habit of the hybrids (in percent)

H a b i t	F ₁	F ₂	F ₃
Indeterminate	52	9.0	12.7
Semi-indeterminate	24	36.4	5.5
Determinate	24	54.6	81.8

Only the indeterminate and semi-indeterminate hybrids segregated. The positions of both stigma and cotyledon were intermediate in F₁. Segregation in F₂ and F₃ for the position of cotyledons was quite varied. It was carried in six of seven groups of Smartt (1970). In F₂ and especially in F₃ the percentage of the hybrids with hypogeal location of the cotyledons was higher compared to those with epigeal location of cotyledons (table 2)

In 23 % of the hybrids in F₂ and in 11 % of the hybrids in F₃ we observed an open stigma.

The segregation of the characters size of cotyledons, colouring of the stem, flowers and seeds, length and number of the inflorescences' internodes, pods' shape etc., were also defined.

55 % of the hybrids in F₂ and 30 % in F₃, 44 % in BC₁ and 35 % in BC₁F₁ matured 3 to 11 days earlier compared to "Amboy". The early-maturity of hybrids in BC₁ depends on the

genotype of *Phaseolus vulgaris* cultivars. Backcrossing with Rodeo and Mastilen resulted in the earliest-maturing hybrids.

Table 2
Segregation for cotyledon position (in percent)

Cotyledon position	F ₂	F ₃	BC ₁	BC ₁ F ₁
hypogeal (as <i>Ph. coccineus</i>)	8.3	36.8	5.6	3.6
cotyledons breaking surface	8.3	7.5	4.5	0.7
cotyledons clearing surface, not expanding	4.2	10.6	1.1	-
cotyledons clearing surface and expanding	8.3	3.0	6.7	3.6
epicotyl/hypocotyl length > 1 (as in F ₁)	66.7	38.3	56.1	-
epicotyl/hypocotyl length < 1 (as in <i>Ph. vulgaris</i>)	4.2	3.8	25.8	92.2

The fertility of the pollen of F₂ hybrids was much greater than that of F₁; 60 % of the hybrids had pollen stainability of 60 to 100 %. About 50 % of the hybrids in F₂ were sterile. The correlation between the fertility of the pollen and that of the seeds in F₂ was low ($r = 0.43$). The fertility of the pollen of the hybrids in F₃ was poorer than that of F₂ hybrids and the fertility of the seeds was even more reduced - 76.0 % of the hybrids were sterile. No correlation was observed between the fertility of pollen and seed fertility in F₃ ($r = 0.08$). The highest percentage of fertile plants was observed among those with lilac and pink (36.0 % and 50.0 % respectively) flowers; 38.8 % of the hybrids with red flowers formed seeds; the lowest percentage (15.24) of fertile plants was observed among the hybrids with white flowers. The fertility of the hybrids in BC₁ and BC₁F₁ was considerably higher.

EFFECTS OF PLANTING MAIZE AND BEANS IN MONOCULTURE AND IN ASSOCIATION AT RELATIVE DATES

O. T. Edje
Bunda College of Agriculture
P.O. Box 219
Lilongwe, Malawi

INTRODUCTION

The growing of crops in association (mixed cropping) is a common cropping system in the tropical environment. It is popular among smallholder farmers for various reasons. These include: increased productivity, more efficient use of scarce resources, greater utilisation of environmental resources, more certain of yield, improvement in soil fertility, weed sup-