EFFECT OF GIBBERELLIN TREATMENT ON THE EXPRESSIVITY OF MUTANT GENES IN HOMO- AND HETEROZYGOUS CONDITION

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A mutant allele, when present in a heterozygous condition along with the wildtype allele at the same locus, may exert an influence ranging from a very small effect (detectable only by special means) to co-dominance to overdominance (i.e. monogenic heterosis). I studied this question by measuring the influence of gibberellin on a series of mutants, when the mutants were in either the homozygous or heterozygous condition.

In this experiment ten mutant lines were used, all ten having been induced in the dwarf pea 'Polzunok'. The mutants were crossed with the initial form. Both F1 and F2 were studied. All were found to be recessive nuclear mutations, monohybrid segregations being observed in F2.

Seedlings of the initial form, mutants, and heterozygotes for mutant genes were treated at the 3-4 node stage with gibberellin (50 mg/1 solution gibbersib). Two treatments were made, three days apart. The solution was placed on the growing point of a stem. Fifty plants of each variant were studied under field conditions.

The initial line showed a decrease of seed productivity but not a change of stem height in response to the exogenously applied gibberellin (Table.1). The mutants responded to gibberellin in different ways. In lines 117, 120, 360, 351 an increase was observed in both stem height and seed productivity. In the other mutants the reaction to gibberellin was expressed as a change (increase or decrease) of only some features. In lines 1110 and 1136 response was observed for stem height but they were neutral or negative for seed productivity.

All heterozygotes for mutant genes considerably exceeded corresponding homozygotes for productivity. In order to reveal the monohybrid heterosis, heterozygotes for mutant genes were compared with the normal homozygote, i.e. with the initial line Polzunok. In all heterozygotes without gibberellin treatment heterosis was not observed. A heterosis effect was observed in the majority of heterozygotes under gibberellin treatment. Similar results were obtained in another experiment with mutants induced in the tall pea 'Torsdag'.

It is concluded that the hormonal system plays an important role in the expression of heterosis.

Table 1. Effect of gibberellin treatment on the productivity of the initial line Polzunok, induced mutants, and F_1 hybrids.

Mutant Hybrid	Height, cm		Number of pods		Number of seeds		Weight of seeds	
	With GA	Without GA	With GA	Without GA	With GA	Without GA	With GA	Without GA
Initial line Polzunok	32.1±1.36	33.4±4.01	10.0±0.58	7.2±1.06	40.8±0.79	25.6±5.98	4.8±1.10	3.2±1.16
Mutant 117	11.9±1.06	21.8±0.92	3.0±0.37	5.6±0.36	6.1±1.16	15.1±1.25	0.9±0.20	2.1±0.21
Polzunok x 117	26.4±1.58	37.0±0.78	7.6±1.17	9.0±0.75	28.0±4.52	36.2±3.28	4.5±0.71	3.7±0.47
Mutant 120	11.5±0.46	15.8±0.66	2.5±0.43	3.5±0.46	4.6±0.81	7.1±1.24	0.6±0.12	0.9±0.16
Polzunok x 120	29.4±0.81	36.2±1.46	7.9±0.56	9.4±1.09	27.5±2.00	32.1±3.89	3.9±0.33	4.8±0.57
Mutant 360	12.6±1.03	22.0±1.17	2.8±0.55	6.9±1.16	6.9±1.39	15.3±2.51	1.1±0.20	1.6±0.20
Polzunok x 360	25.4±1.08	28.0±1.56	7.2±0.98	8.3±1.04	30.2±3.69	31.0±2.79	3.6±0.50	4.4±0.38
Mutant 362	22.2±1.00	20.9±1.70	8.0±1.05	4.0±0.89	21.4±2.73	11.9±3.77	5.4±1.23	1.6±0.55
Polzunok x 362	29.1±0.73	34.7±1.40	8.2±0.62	9.9±1.01	34.4±2.39	39.0±4.25	4.9±0.37	4.9±0.60
Mutant 1110	18.3±0.60	26.6±0.90	7.2±0.80	5.4±0.47	19.0±1.77	13.6±1.13	2.2±0.23	1.3±0.17
Polzunok x 1110	33.2±1.30	39.3±1.19	9.3±1.55	9.7±0.91	36.0±6.25	38.3±3.91	5.1±0.78	4.5±0.56
Mutant 1134	23.0±0.70	27.5±1.00	7.0±0.60	7.0±0.79	13.0±1.05	19.4±2.58	2.4±0.18	3.0±0.45
Polzunok x 1134	32.4±0.57	42.4±1.37	8.7±0.73	11.6±1.09	34.2±2.58	48.6±5.84	5.2±0.45	6.8±0.81
Mutant 1136	18.0±0.73	22.7±0.93	4.0±0.30	3.4±0.40	16.8±1.26	11.9±1.18	2.0±0.19	1.4±0.19
Polzunok x 1136	28.7±0.97	34.8±1.27	6.8±0.63	8.9±0.78	32.2±2.56	34.3±2.56	4.3±0.44	4.8±0.35
Mutant 1170	17.6±0.69	19.1±1.08	6.8±1.01	7.3±0.75	16.2±2.37	19.6±1.91	1.6±0.22	2.3±0.25
Polzunok x 1170	31.9±0.94	35.2±1.99	8.4±0.72	9.4±1.29	34.5±2.96	36.9±5.15	4.7±0.40	4.0±0.65
Mutant 1201	16.3±0.67	25.7±0.85	7.3±0.54	9.5±1.12	20.4±1.75	22.3±3.40	2.4±0.24	2.7±0.40
Polzunok x 1201	28.1±1.12	36.4±0.96	10.4±1.17	11.3±0.85	39.4±4.21	47.8±3.77	6.1±0.64	6.1±0.57
Mutant 351	36.0±3.58	50.9±2.03	5.4±1.78	8.9±1.09	12.8±4.60	20.1±3.00	1.8±0.83	2.7±0.45
Polzunok x 351	27.2±0.97	41.8±1.42	5.7±0.52	10.0±0.80	25.3±2.44	46.2±3.92	4.7±0.53	6.0±0.66