II. EMS AND NEU MUTAGENIC EFICIENCY AND EFFECTIVENESS IN INDUCTION OF MORPHOLOGICAL MUTATIONS IN PHASEOLUS VULGARIS L.

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INTRODUCTION

In comparison to the chlorophyll mutations, morphological are more interesting for breeders because they can find, between them, forms representing specific breeding interest. Evaluation of mutability by frequency of phenotypic changes cannot be identical with induced breakings in cells. There are many biological barriers in fixation of mutations. Despite this fault, checking of visual mutations is widely used as enough objective method for evaluation of mutagenic efficiency and genotype mutability.

MATERIAL AND METHODS

Five years results with Bulgarian common bean varieties Dobroudjanski 7; Dobroudjanski 2; Plovdiv 11M and Plovdiv 10 were included as average in that study. Mutagenic factors were applied in the next concentrations: ***EMS⇒ 2,5·10^{-2}; 1,25·10^{-2}; 6,2·10^{-3} M*** and ***NEU⇒ 6,2·10^{-3}; 3,1·10^{-3}; 1,55·10^{-3} M.*** Buffers with pH 6,0 and 7,0 were used as controls.

Morphological mutations were determined by classification of Ivanov (1961). As a criterion for mutagenic efficiency was used the coefficient of efficiency:

$$(C.E. = \frac{frequency\ \ of\ surviving\ \ (\%\ M\,1)}{100}\ x\ \frac{frequency\ \ of\ mutations\ \ (\%)}{100}),$$ (Krausse, 1968 by Mehandjiev et al., 1981), while mutagenic effectiveness was calculated on the basis of ratio ***Msd/L. Msd*** was the amount of mutations based on 100 M_2 plants and ***L*** was the lethality (Konzak et al., 1965 by Mehandjiev et al., 1981).

RESULTS AND DISCUSSION

Mutagenic efficiency (C.E. – Table 1) was different for all studied varieties. It was the highest in treatments with the lowest in lethality concentrations (1,55·10^{-3}M NEU and 6,2·10^{-3}M EMS – LD_{25-30}) for variety Plovdiv 11M, while middle of lethality concentrations applied on variety Plovdiv 10 (3,1·10^{-3}M NEU and 1,25·10^{-2}M EMS – LD_{45-50}) were more efficient. There were not found very clear dependences for varieties Dobroudjanski 7 and Dobroudjanski 2.

Mutagenic effectiveness (Table 1) was in dependence of studied varieties, applied mutagens and concentrations. There were found specific varieties' peculiarities. For example, the most effective for variety Dobroudjanski 7 were mutagenic treatments with middle of lethality concentrations, while for Plovdiv 10 the most effective were treatments with the highest of lethality concentrations of NEU and EMS. Despite higher values of **C.E.** and **Msd/L,** showed after application of middle (3,1·10^{-3}M NEU and 1,25·10^{-2}M EMS – LD_{45-50}) or low (1,55·10^{-3}M NEU and 6,2·10^{-3}M EMS – LD_{25-30}) by lethality concentrations of two applied mutagens, they are not the most efficient and effective for induction of wide mutation spectra and the highest mutation frequencies. As is known, mutation spectrum and frequency are very important indexes for discovery and selection of more interesting mutants with valuable breeding indications. It is interesting to point that not every time on higher mutagenic efficiency corresponded higher effectiveness. It is due to wideness of mutation spectra, different lethality in plants after application of mutagenic concentrations and different surviving of plants in M_1 generation. Therefore, when we have to choose the mutagenic treatment for creation of bigger mutation diversity and selection of valuable common bean mutants, it is important to evaluate mutation frequency, spectra, coefficient of efficiency and mutagenic effectiveness (Mehandjiev et al., 1981; 1985).

Table 1. EMS and NEU mutagenic effectiveness and efficiency in induction of morphological mutations

Treatments	% lethality, in M_1 generation	Number of mutations	Mutation frequency, in %	*C.E.*	*Msd/L*	% lethality, in M_1 generation	Number of mutations	Mutation frequency, in %	*C.E.*	*Msd/L*
Variety Dobroudjanski 7						**Variety Plovdiv 11 M**				
Control pH 6,0	9,8	1	0,10 ± 0,10	0,0009	0,010	7,95	2	0,16 ± 0,11	0,0015	0,020
$6,2\cdot10^{-3}$ M HEK	81,73	106	10,09 ± 0,93	0,0184	0,123	81,13	181	14,76 ± 1,01	0,0278	0,182
$3,1\cdot10^{-3}$ M HEK	67,73	91	9,99 ± 0,99	0,0322	0,147	65,44	158	13,06 ± 0,97	0,0451	0,199
$1,55\cdot10^{-3}$ M HEK	51,34	91	7,23 ± 0,73	0,0352	0,141	49,51	149	11,78 ± 0,91	0,0595	0,238
Control pH 7,0	12,61	4	0,18 ± 0,09	0,0016	0,014	12,9	2	0,18 ± 0,13	0,0016	0,014
$2,5\cdot10^{-2}$ M EMC	78,8	95	7,32 ± 0,72	0,0155	0,093	75,9	150	12,43 ± 0,95	0,0300	0,164
$1,25\cdot10^{-2}$ M EMC	64,1	86	7,20 ± 0,75	0,0259	0,112	62,1	135	11,14 ± 0,90	0,0422	0,179
$6,2\cdot10^{-3}$ M EMC	50,7	77	3,45 ± 0,39	0,0170	0,068	49,2	102	8,33 ± 0,79	0,0423	0,169
Variety Dobroudjanski 2						**Variety Plovdiv 10**				
Control pH 6,0	8,7	2	0,19 ± 0,13	0,0017	0,022	8,56	1	0,09 ± 0,09	0,0008	0,010
$6,2\cdot10^{-3}$ M HEK	80,6	140	12,37 ± 0,98	0,0240	0,153	82,2	73	6,73 ± 0,76	0,0120	0,082
$3,1\cdot10^{-3}$ M HEK	65,8	144	11,36 ± 0,89	0,0388	0,173	65,4	49	4,21 ± 0,59	0,0146	0,064
$1,55\cdot10^{-3}$ M HEK	49,8	126	10,50 ± 0,88	0,0527	0,211	50,8	26	2,11 ± 0,41	0,0104	0,041
Control pH 7,0	13,3	2	0,15 ± 0,11	0,0013	0,011	13,3	1	0,09 ± 0,08	0,0008	0,007
$2,5\cdot10^{-2}$ M EMC	76,9	116	10,20 ± 0,90	0,0236	0,133	76,73	53	4,31 ± 0,58	0,0100	0,056
$1,25\cdot10^{-2}$ M EMC	62,1	122	9,50 ± 0,82	0,0360	0,153	62,9	37	3,21 ± 0,52	0,0119	0,051
$6,2\cdot10^{-3}$ M EMC	49,8	57	4,60 ± 0,60	0,0231	0,092	50,1	20	1,96 ± 0,43	0,0098	0,039

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