

8. The effect of mutagens manifested itself in all evaluated generations and the applied MNH concentrations and X-rays doses did not substantially influence vitality and fertility of the plants. They can be therefore recommended for similar experiments in *T. monococcum* L. and akin species.

Literature

- D'AMATO, F., SCARASCIA-MUGNOZZA, G. T., and BOZZINI, A.: Mutanti vitali di frumento duro ottenuti del laboratorio per le applicazioni in agricoltura del C. N. E. N. con impiego di radiazioni ionizzanti e mutageni chimici. *Genetica Agraria* XVIII (1—2): 132—141, 1964.
- ANDREJEV, V. S.: Genetičeskij mehanizm radiostimulacii rastenij. *Predposevn. oblučeniye semjan selskochozjajstvennykh kultur*. Moskva, AN SSSR, 28—38, 1963.
- ANDROŠČUK, A. F.: Minlivist roslin viklikana dieju dljakich chimičnich mutagennich rečov. *Ukr. botaničnij žurnal* 23 (5): 28—34, 1966.
- ANDROŠČUK, A. F., and MARECHA, L. N.: Inducirovannaja pestrolistnost' jačmenja v M_1 , jejo nasledovaniye i mikrosporogenez. *Citologija i genetika* 2 (1): 30—34, 1968.
- BAGNARA, D.: Variabilità genetica in caratteri quantitativi di frumento duro indotta da mutageni fisici e chimici. *Atti Assoc. Genet. Ital.* 10: 150—167, 1965.
- BHASKARAN, S., and SWAMINATHAN, M. S.: Polyploidy and radiosensitivity in wheat and barley. 2. Survival, pollen and seed fertility and mutation frequency. *Genetica* 32 (3): 200—246, 1961.
- BHATIA, C. R., and SWAMINATHAN, M. S.: Induced polygenic variability in bread wheat and its bearing on selection procedures. *Z. Pflanzenzücht.* 48 (4): 317—326, 1962.
- BROCK, R. D.: Induced mutations affecting quantitative characters. Report of the Meeting organized by FAO of the United Nations and the IAEA. Italy, Rome, 451—464, 1965.
- CETL, I.: Indukované mutace kvantitativních znaků a možnosti jejich šlechtitelského využití. *Sb. O metodách a výsledcích mutačního šlechtění*, 43—51, 1966.
- FRÖIER, K., and GUSTAFSSON, Å.: The influence of seed size and hulls on X-rays susceptibility in cereals. *IDEM.* 30: 583—589, 1944.
- FUJII, T.: Radiosensitivity in plants. IV. Experiments with several mutant strains of einkorn wheat. *Japan J. Genetics* 35 (4): 110—119, 1960.
- FUJII, T.: Mutations in einkorn wheat induced by X-rays. VI. Segregation ratio and viability of several chlorophyll mutants. *Seiken Zihô, Rept. Kihara Inst. Biol. Res.* 11: 12—20, 1960.
- FUJII, T., and YUKIO, O.: Relation between chlorophyll content and free amino acids in einkorn wheat mutants. *Proc. Japan Acad.* 37 (10): 633—637, 1961.
- FUJII, T.: Chlorophyll mutations in einkorn wheat induced by radiation. *Seiken Zihô, Rept. Kihara Ins. Biol. Res.* 13: 138—143, 1962.
- FUJII, T.: Chlorophyll mutations induced by radiation in einkorn wheat and their occurrence in clusters. *Seiken Zihô, Rept. Kihara Inst. Biol. Res.* 14: 1—11, 1962.
- FUJII, T.: Relative biological effectiveness of 14-MeV fast neutrons to Co^{60} gamma rays in einkorn wheat. *Biol. Effect Neutron and Proton Irradiat.*, Vienna, 2: 217—230, 1964.
- FUJII, T.: Effect of 14 MeV neutrons in heterozygotic einkorn wheat. *Japan J. Genetics* 40 (3): 209—218, 1965.
- FUJII, T., and MATSUMURA, S.: Comparison of mutagenic efficiency between ethyl methane-sulfonate and ionizing radiations in diploid wheat (Preliminary report), *Seiken Zihô, Rept. Kihara Inst. Biol. Res.* 18: 23—31, 1966.
- GÁBORČÍK, Š., and SRB, V.: Klíčivost semen některých druhů trav z čeledi lipnicovitých (Poaceae) po ozáření RTG paprsky. *Genetika a šlechtění* 3 (2): 101—108, 1967.
- GAUL, H.: Ungewöhnlich hohe Mutationsraten bei Gerste nach Anwendung von Ethylmethan-sulfonat und Röntgenstrahlen. *Naturwissenschaften* 49 (18): 431, 1962.
- GAUL, H.: Induced mutations in plant breeding. *Genet. Today* 3: 689—709, 1964.
- GAUL, H.: Mutations in plant breeding. *Radiat. Bot.* 4: 155—237, 1964.
- GAUL, H.: Selection in M_1 generation after mutagenic treatment of barley seeds. *Induction of Mutations and the Mutation Process*, Prague, 1—11, 1965.
- GAUL, H., and AASTVEIT, K.: Induced variability of culm length in different genotypes of hexaploid wheat following X-irradiation and EMS-treatment. *Contemp. Agric.* 11—12: 263—276, 1966.
- GAUL, H.: Studies on populations of micromutants in barley and wheat without and with selection. *Abhandl. Dtsch. Akad. Wiss. Berlin Kl. Med.* 2: 269—283, 1967.

- GAUL, H., and ULONSKA, E.: Züchterische Bedeutung von Kleinmutationen. II. Durch Röntgenstrahlen induzierte Variabilität von Kornertrag, Korngröße und Vegetationslänge bei den Gersten Volla und Wisa. Z. Pflanzenzücht. 58 (4): 343—368, 1967.
- GICHNER, T., and VELEMÍNSKÝ, J.: Induction of chlorophyll chimeras by X-rays and ethyl methanesulphonate (EMS) in different heterozygous strains of *Arabidopsis thaliana*. Induction of Mutations and the Mutation Process, Prague, 54—56, 1965.
- GICHNER, T.: Chemomutageny. Praha, 1—148, 1968.
- GOUND, J. V.: Variegated mutant in hexaploid wheat. Current Sci. (India) 36 (6): 162, 1967.
- GREGORY, W. C.: Efficacy of mutation breeding. Mutation and Plant Breeding NAS/NRC Pub. 891: 461—486, 1961.
- GREGORY, W. C.: A radiation breeding experiment with peanuts. Radiat. Bot. 8 (2): 81—147, 1968.
- HAARING, R.: Mutationsauslösung durch Chemikalien bei Weizen. III. Unterschiedliche Folgen einer Mutagenen Behandlung von verschiedenartigen Zellen. Z. Pflanzenzücht. 48 (2): 117—142, 1962.
- HRUBÝ, K., and KONVIČKA, O.: Polní pokusy, jejich zakládání a hodnocení. Olomouc, 1954.
- CHOPRA, V. L., and SWAMINATHAN, M. S.: Mutagenic efficiency of individual and combined treatments of ethylmethane sulfonate and hydroxylamine in emmer wheat. Indian J. Genet. and Plant Breed. 26 (1): 59—62, 1966.
- JALIL, M. A., and YAMAGUCHI, H.: Experiments on the induction of polygenic mutations with successive irradiation in rice. Fyton 21 (2): 149—155, 1964.
- JALIL, M. A., and YAMAGUCHI, H.: The variation of quantitative characters in the irradiated progenies of two rice varieties and their hybrids. Radiat. Bot. 5: 187—196, 1965.
- JALIL, M. A., and YAMAGUCHI, H.: Variation in quantitative characters of X_2 plants after hybridization and irradiation in rice. Japan. J. Breed. 15 (2): 91—96, 1965.
- JECH, Z., HANIŠ, M., REJMAN, B., LANGROVÁ, M., and HODOVÁ, H.: Změna kvality zrna odrůdy ozimé pšenice „Salzmünder Bartweizen“ působením mutagenů. Genetika a šlechtění 5: 29—35, 1969.
- KONZAK, C. F., RAMIREZ, A. I., and WOO, S. C.: Development of genetic methods for wheat improvement. Mutations in Plant Breeding, Vienna, 2: 183—192, 1968.
- LAMPRECHT, H.: Classification system of leaf colour mutants. Agr. hort. Genet. 18: 135, 1960.
- MAKAROVA, S. I., and ZOZ, N. N.: Inducirovannyje sistemnyje mutacii u pšenicy. Genetika 2: 113—118, 1965.
- MAKAROVA, S. I.: Někotoryje zakonomernosti dějstvija N-nitrosoalkilmočeviny na rastěnija. Sb. Supermutageny, Moskva, 116—121, 1966.
- MATSUMURA, S., and FUJII, T.: Radiation genetics in wheat II. Seiken Zihô, Rept. Kihara Inst. Biol. Res. 7: 45—51, 1955.
- MATSUMURA, S.: Radiation genetics in wheat. V. Influence of irradiation time and temperature on the genetic effects of ionizing radiation in diploid wheat. Japan. J. Genetics 35 (7): 197—204, 1960.
- MATSUMURA, S.: Radiation genetics in wheat. VI. Biological effects of thermal and fast neutrons on diploid wheat. Japan J. Genetics 36 (3—4): 84—96, 1961.
- MATSUMURA, S.: Radiation induced variegations in einkorn wheat and their inheritance. Seiken Zihô, Rept. Kihara Inst. Biol. Res. 13: 75—88, 1962.
- MATSUMURA, S.: RBE and dose rate for radiation effects in wheat. Seiken Zihô, Rept. Kihara Inst. Biol. Res. 13: 155—159, 1962.
- MATSUMURA, S., and FUJII, T.: Radiosensitivity in plants. VII. Relation between polyploidy and radiosensitivity under chronic condition. Seiken Zihô, Rept. Kihara Inst. Biol. Res. 17: 17—23, 1965.
- OKA, H. I., HAYASHI, J., and SHIOJIRI, I.: Induced mutations of polygenes for quantitative characters in rice. J. Hered. 49: 11—14, 1958.
- PIERRE, V.: Augmentation du rendement et des qualités des cultures par irradiation des semences. Inds. atom. 3 (1—2): 77—84, 1959.
- PRIKLADOV, N. V.: Vozdějstvije lučej radija na prorastajuščije semena pšenicy. Bjul. Sibirsk. botan. sada 5: 85—87, 1958.
- RAUL, A., and KENNETH, F. J.: Variation in quantitative characters of oats (*Avena sativa* L.) after various mutagen treatments. Crop. Sci. 4 (2): 163—168, 1964.
- ŘÍMAN, L.: Vplyv mutagenných činitelov C, EMS, NMH a NEM na kličenie a vzchádzanie viacročných krmovín. Genetika a šlechtění 3 (1): 5—12, 1967.
- ŘÍMAN, L.: Vliv mutagenních činitelů typu EMS, NMM a NEM na vznik chlorofylových defektů víceletých píceň v raných fázích vývoje M_1 generace. Genetika a šlechtění 4 (1): 59—62, 1968.

- SAX, K.: The effect of ionizing radiation on plant growth. *Amer. Journ. Botany* 42 (4): 360—364, 1955.
- SAX, K., and SAX, H. J.: Effect of chronological and physiological aging of onion seeds on the frequency of spontaneous and X-ray induced chromosome aberrations. *Radiat. Bot.* 4: 37—41, 1963.
- SCARASCIA, G. T., AVANZI, S., BOZZINI, A., CERVIGNI, T., D'AMATO, F., DONINI, B., and GIACOMELLI, M.: Effects of radiations and chemical mutagens in durum and bread wheats. *Effects Ionizing Radiat. on Seeds*. IAEA, Vienna, 387—400, 1961.
- SCOSSIROLI, R. E., FERRARI, A., and HAUSSMAN, G.: Variabilita genetica per caratteri quantitativi nella medica. *Atti A. G. I.*, V, 1960.
- SCOSSIROLI, R. E., and PELLEGRINI-SCOSSIROLI, S.: Use of radiation applied to seeds to induce new genetic variation for quantitative traits in durum wheat. *On Genetics and Wheat Breeding*, Martonvásár (Hungary), 230—236, 1962.
- SCOSSIROLI, R. E., and PELLEGRINI-SCOSSIROLI, S.: Analisi della variabilita fenotipica in progenie ottenute da semi trattati con raggi X e da semi non trattati in *T. durum*. *Atti. Ass. Genet. It.*, Pavia, 8, 1963.
- SCOSSIROLI, R. E.: Coseguenze su caratteri quantitativi del trattamento dei semi con raggi X in *T. durum*. *Eterogeneità fenotipica di progenie derivate da semi trattati e non trattati*. *Atti. Ass. Genet. It.*, Pavia 11: 147—160, 1966.
- SCOSSIROLI, R. E.: Induction of mutations for quantitative characters. *Abhandl. Dtsch. Akad. Wiss. Berlin Kl. Med.* 2: 283—286, 1967.
- SHKVARNIKOV, P. K., CHERNY, I. V., and GORIN, V. E.: Relative frequency of induced mutations of quantitative and morphological characters in wheat. *Mechanism Mutat. and Induc. Factors*, Prague, 121—124, 1966.
- SHEIBE, A., and MEYER, H.: Mutationsauslösung durch Chemikalien bei Weizen. 1. Die Anschnittmethode und erste Ergebnisse. *Z. Pflanzenzücht.* 47 (2): 181—192, 1962.
- SMITH, L.: Mutants and linkage studies in *Triticum monococcum* and *T. aegilopoides*. *Agric. Exp. Sta. Univ. Miss. Res. Bull.* 298: 1—26, 1939.
- SMITH, L.: Hereditary susceptibility to X-ray injury in *Triticum monococcum*. *Amer. Jour. Bot.* 29: 189—191, 1942.
- SMITH, L.: Effect of atomic bomb radiation and X-rays on seeds of cereals. *J. Hered.* 41: 125—130, 1950.
- SRB, V., and HORA, L.: Klíčivost semen některých odrůd *Allium cepa* L. ozářených RTG paprsky. *Genetika a šlechtění* 2 (3): 161—168, 1966.
- STADLER, L. J.: Chromosome number and the mutation rate in *Avena* and *Triticum*. *Proc. Nat. Acad. Sci.*, Wash. 15: 876—881, 1929.
- STADLER, L. J.: Some genetic effects of X-rays in plants. *J. Hered.* 21: 3—19, 1930.
- VAGERA, J.: Morfologické odchylky ve stavbě klasů různých druhů rodu *Triticum* L. jako důsledek dekapitace metajících rostlin. *Publ. Fac. Sci. Univ. J. E. Purkyně, Brno, Tchechoslovaquie*, 461: 143—160, 1965.
- VAGERA, J.: The effect of N-nitroso-N-methylurea, buthylmethane sulphonate and X-rays on the germination and production of chlorophyll mutations in einkorn wheat. *Biol. Plantarum* 11 (6): 408—416, 1969.
- VAGERA, J.: Účinek N-nitroso-N-methylmočoviny, butylmethansulfonátu a paprsků X na dědičnou proměnlivost některých fyziologických vlastností u pšenice jednozrny v M₂. *Sb. Ped. fak. University Palackého, Olomouc. Přírod. vědy*, 95—138, 1969.
- WILLIAMS, J. H., and HANWAY, D. G.: Genetic variation in oil and protein content of soybeans induced by seed irradiation. *Crop. Sci.* 1 (1): 34—36, 1961.
- ZOZ, N. N.: Izmenčivost pyrejno-pšeničnych gibridov podvozdstvijem chimičeskich mutagenov. *Dokl. AN SSSR* 137 (2): 426—427, 1961.
- ZOZ, N. N.: Nasledovaniye izmenenij, vyzvannyh chimičeskimi mutagenami u pšeničnopyrejnych gibridov. *Dokl. AN SSSR* 145 (1): 187—188, 1962.
- ZOZ, N. N.: Izmenčivost pšenicy vyzvannaja chimičeskimi mutagenami. *Izv. AN SSSR Ser. biol.* 3: 432—437, 1965.
- ZSCHEGE, Ch.: Mutationsauslösung durch Chemikalien bei Weizen. IV. Cytogenetische Untersuchungen an Mutanten. *Z. Pflanzenzücht.* 49 (2): 122—160, 1963.

* Address:

Institute of Experimental Botany
Czechoslovak Academy of Sciences
Sokolovská 6, Olomouc, Czechoslovakia.