Mutation Breeding Newsletter

Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture

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Message from the Editors

This newsletter comes to you with the good wishes of the editors and the staff of the Joint FAO/IAEA Division for a prosperous year 1976. We would be happy if our services are helpful to you and would like to request your continued cooperation.

Alexander Micke
Margret Weiner

Report from the Plant Breeding and Genetics Section

The year 1975 saw a number of events designed for encouragement of research towards important plant breeding objectives. From 5-9 May, scientists from 25 countries and organizations met at Hahnenklee (Federal Republic of Germany) for the Third Research Coordination Meeting on the Use of Nuclear Techniques for Seed Protein Improvement. In September, the Third Research Coordination Meeting on Induced Mutations for Disease Resistance in Crop Plants was held at Ames (Iowa), USA. The First Research Coordination Meeting on the Use of Aneuploids for Wheat Protein Improvement was organized 6-10 October in Vienna, followed by an Advisory Group Meeting on Induced Mutations in Cross Breeding. And finally, a Regional Seminar on Grain Legume Improvement by Nuclear Techniques was held at Colombo (Sri Lanka), 8-12 December. Sometimes we hear complaints, particularly from very active researchers, about too many meetings being organized worldwide causing a strain on the scientists' time and budget. The meetings listed above, however, were actually workshops, providing an opportunity to discuss also unpublishable results and to plan future research activities. We were repeatedly assured that this type of meeting is much appreciated by participants and yields rather good benefits.

The international symposium planned for 1975 had to be cancelled due to political developments in the foreseen host country.

A considerable part of our activities refers to supporting research in FAO and IAEA Member States and related training. In 1975 we directed Technical Assistance Projects in Brazil, Burma, Indonesia and Pakistan, and provided training opportunities to fellows from Bangladesh, Brazil, Cyprus, Czechoslovakia, Ethiopia, Indonesia, Korea, Pakistan, Romania and Sri Lanka. Through our research contract programme we have given research grants to 42 institutes primarily in developing countries and facilitated research partnerships by research agreements with 39 other institutions.

A new coordinated research programme on the use of aneuploids for protein improvement in wheat was initiated in October 1975. Understanding of the genetic factors controlling the endosperm proteins and nitrogen metabolism in wheat was the main theme of the first research coordination meeting. After considering the available evidences, among other things a cooperative experiment using Chinese Spring ditelocentric lines was planned in order to arrive at some definite conclusions as to which chromosomes or chromosomal arms have the largest effect on protein and lysine content. This experiment will be grown at eight different locations. Final compilation of data and statistical analyses will be carried out by Dr. C.N. Law (Plant Breeding Institute, Cambridge). The results are expected by November 1976.

Mutation experiments using monosomic stocks for different chromosomes, already known to carry gene(s) for protein content, will be initiated at different laboratories. The group also emphasized the need to establish a centre for the maintenance and preservation of genetic stocks of wheat. A brief report of the meeting will appear shortly in Cereal Research Communications. The recommendations of the meeting are available (please write to Dr. C.R. Bhatia).

The staff of the Plant Breeding Section is presently as follows:

Section Head:	Dr. Alexander Micke (FRG)
Section Staff:	Dr. Knut Mikaelsen (Norway)
	Dr. Robert Rabson (USA)
	Dr. C.R. Bhatia (India)
Laboratory Staff:	Dr. Thorsten Hermelin (Sweden)
	Dr. Helmut Brunner (Austria)
	Ing. Gertrude Adam (Austria)

For 1976 we expect to acquire the services of a professional plant pathologist who will help us to strengthen our efforts in the field of disease resistance.

RESEARCH NEWS

The spring barley mutant cultivar 'Diamant', its economic importance and breeding value

Spring barley 'Diamant' represents a positive mutation obtained after X-irradiation of dry seeds of 'Valtický' cultivar. 'Valtický' originated from the old Moravian land varieties. Due to its good agronomical characters, yields and grain quality, 'Valtický' spread quickly into all regions of Czechoslovakia and was the leading variety in the sixties. This cultivar was also extensively grown in the Soviet Union and to a smaller extent in Austria, Hungary and Poland.

In 1956, dry seeds (moisture content 14 per cent) of 'Valtický' were acutely irradiated with X-rays. Doses of 500, 1000, 2500, 5000, 7500 and

10,000 R were applied. In each treatment, 1000 grains were exposed. M_1 plants were harvested individually and their progenies were sown into M_2. Within a variant of 10,000 R, a progeny was detected that seemed to have higher tillering capacity and shorter stem. This M_2-progeny No. 228 represented a basic stock for 'Diamant' cultivar. Considering that practical breeding was the only purpose of the work, the frequencies of induced mutations were not fully recorded. Since M_3 generation, pedigree method of breeding was started. A mutant line called VR_z was registered in the list of Czechoslovak approved cultivars under the name 'Diamant' in 1965.

In comparison with the parent cultivar, the mutant differs in the following characters:

a) tillering is 10-14 days delayed and growing apex shows retarded development during stages I-V especially under short-day conditions;

b) tillering is increased, number of fertile tillers being greater by 2-3; it has spreading or even prostrate growth habit until the end of tillering stage;

c) due to shorter stem internodes, the stem is 10-15 cm shorter;

d) proportion of grain to straw is 1:0.94 while 'Valtický' had 1:1.2;

e) the yield of grain has been at least 10 per cent higher or more and on country average 'Diamant' reached 0.4 - 0.6 t/ha higher yields than the other cultivars on the acreage several hundred thousand hectares in 1969-72.

For quality of grain and malt, 'Diamant' equals the parent material, the 'Valtický' cultivar, which was the Czechoslovak standard malting control.

Analyses indicate that mutated characters are recessive and controlled mostly by 1-2 genes.

'Diamant' became the leading cultivar in Czechoslovakia in the early seventies. Nevertheless, it has had some negative characters, too. Productivity of ear, mildew resistance, stem breaking after ripening and seed assorting needed to be improved. Series of crosses of 'Diamant' with diverse cultivars have been started since 1963, which resulted in series of new cultivars: so far Ametyst, Hana and Favorit (Czechoslovakia) and Trumpf (German Democratic Republic).

The new cultivars of a "Diamant series" have retained growth habit, short straw and quality of grain of 'Diamant'. Assorting of grain, TKW, resistance to powdery mildew, stem breaking and lodging resistance have been improved. Yield of grain is 5-10 per cent higher than with 'Diamant'. This "Diamant series" of cultivars occupies now 92 per cent of barley acreage in Czechoslovakia and 'Trumpf' cultivar spreads quickly in the German Democratic Republic and indicates good results abroad (FRG, ČSSR).

(Contributed by J. Bouma, through the Czechoslovak Atomic Energy Commission, Prague).

Blast resistance mutations in rice

Induced mutation experiments were initiated in 1970 by treating seeds of variety Nahda with Gamma rays, fast neutrons and EMS. Selections for higher levels of blast resistance were made in the M_3 population and repeated in the M_4. The selected lines were grown during 1974 in the M_5 and sprayed with spore suspension of *Pyricularia oryzae* one month after transplanting. Parent and the selected mutant populations were screened two weeks after inoculation on line basis using the scale suggested by Ou. Blast reaction of the selected lines was 2 in contrast to 5-6 of the parental variety Nahda. Seed of the resistant lines is available for testing at other locations.

(Contributed by M.S. Balal, Rice Research Section, Field Crop Research Institute, Agricultural Research Centre, Orman, Giza, Egypt).

Wheat mutants with improved protein?

In the last issue of this Newsletter, under the same heading as this one, a scatter diagram showing relative dye binding capacity (DBC) and ninhydrin nitrogen in grain hydrolysate for induced wheat mutants sent to us from different laboratories was published. All mutants showing higher DBC relative to ninhydrin nitrogen were reanalyzed. Most of them repeated the higher DBC relative to nitrogen confirming the previous results. Deviants with reasonably normal looking seeds were analyzed for amino acid composition. However, none of the mutants showed any marked improvement in lysine content or the content of basic amino acids, in spite of the fact that they had shown higher DBC. The seed used for amino acid analyses were from the same lots.

This technique was originally developed and used by Doll (1972) for barley and he was able to pick out deviants like 1508 which later proved to be a high lysine mutant. It has been used in wheat with a similar expectation to initially screen for changes in protein composition. In our aneuploid work, also using this technique, we picked up ditelosomic 2AS as showing maximum deviation from DBC - ninhydrin nitrogen regression. However, amino acid analyses of this line grown at different locations has not shown any significant variation from euploid Chinese Spring. At present, we do not have any explanation for this discrepancy and plan to check the usefulness of this technique for wheat using lines identified as high lysine stocks in the World Wheat Collection.

Reference: Doll, H. (1972)
Variation in protein quantity and quality induced in barley by EMS treatment
In: Induced Mutations and Plant Improvement, IAEA, Vienna, 331-342

(Contributed by C.R. Bhatia and R. Rabson, FAO/IAEA).

Performance of early flowering mutant lines of rice variety Basmati-370

Two mutant lines, namely EF-29-1 and EF-29-2, isolated from the rice cultivar Basmati-370 after treatment with gamma-rays, have been tested in farmers' fields at about sixteen locations in key areas of Punjab during

1974-75. The same mutant lines have also been tested in preliminary trials carried out at the experimental area of NIAB, Lyallpur, from 1972-73 to 1974-75. In all these trials, the parent variety viz. Basmati-370 was grown as check variety. At all the locations, the mutants matured three to four weeks earlier as compared to the parent variety. The yielding ability of these mutant lines has been found identical as that of Basmati-370 (3156, 2880 kg/ha for EF-29-1 and EF-29-2 respectively as against 2972 kg/ha of the parent variety). The main features of the mutant lines EF-29-1 and EF-29-2 are that due to their appreciable earliness, they can vacate the land for timely sowing of wheat crop and also water of two irrigations can be saved. In addition, these mutants possess fine grain characteristics of Basmati rice like strong aroma, good milling and cooking quality.

(Contributed by M.A. Awan and A.A. Cheema, Nuclear Institute for Agriculture and Biology, Lyallpur, Pakistan).

Breeding Solanum khasianum for high solasodine production with the help of induced mutations

Demand for steroidal hormones used in the manufacture of contraceptive pills is increasing at a tremendous rate. The most favoured starting material is diosgenin found in the rhizomes of several Dioscorea species, which grow wild in different parts of the world including India. Due to indiscriminate exploitation of the natural reserves coupled with their poor regeneration and slow growth under cultivation search for alternative sources became imperative (1, 2).

Solasodine, analogue of diosgenin, is found in various species of non-tuberous Solanums. Among the species endemic to India berries of Solanum khasianum were found to be most promising material. It grows wild in humid regions and was brought under cultivation by us. However, only a narrow range of variation in solasodine content was detected, hence a mutation breeding programme was initiated (3). Dry seeds of Solanum khasianum were treated with gamma rays (7.5 to 20 kR); ethylmethane sulphonate (0.05 to 2.0%); ethylenimine (0.05 to 0.10%) and methyl nitrosoguanidine (1 & 2mM). Chemical treatments lasted 18 hrs at 20°C. In M_2 generation, grown on plant progeny basis, 146 mutants were isolated on the basis of their vegetative growth, fruit setting, frequency of spines and resistance to diseases and their alkaloid content was investigated. Mutants possessing more than 0.75% solasodine, less spines and good vegetative growth were selected. Further selection was continued through M_3 and M_4 generations. In M_5 the 8 most promising mutant lines with solasodine content ranging from 2.0% to 3.5% were selected and subjected to early yield trials using a randomised block design. The data have been summarized as shown on the following page.

RRL-20-2 strain has thus shown significant improvement with respect to solasodine yield per hectare. The selection is fairly vigorous in growth having 3-4 fruits per node, has only 2-4 spines on leaf which are almost absent on the stem, and has not shown any susceptibility to diseases, etc. Seeds of this strain were last year released to Central Medicinal Plants Organisation, Jammu, and several other research stations in different agro-climatic zones in India. This year the seeds are being distributed to several private growers for commercial growing.

Summary of the results on the performance of different mutants of S. khasianum

Selection No.	Yield of fresh berries/hectare	Solasodine content, % on dry wt.	Estimated total solasodine yield/hectare
Control	6.12	1.2	18.15
RRL-20-2	5.51	3.0	41.25
RRL-20-5	4.78	2.5	29.75
RRL-20-4	2.39	2.3	13.25
RRL-2.5-10	5.17	2.2	28.45
RRL-15-11	2.15	2.4	14.25
RRL-NG-9A	2.29	1.8	10.25
RRL-10-8A	4.04	2.1	28.25

References: L.D. Kapoor
Search for new vegetable sources for use in family planning
In: Proceedings of 2nd General Congress of SABRAO
New Delhi, 22-28 February 1973, pp. 1194-1199

K.R. Khanna and A.S. Murty
Inheritance of solasodine in Solanum khasianum
Ibid. pp. 1200-1203

B.L. Kaul and Usha Zutshi
Improvement of solasodine in Solanum khasianum through induced mutations
Ibid. pp. 1204-1209

(Contributed by B.L. Kaul, Regional Research Laboratory, Jammu (Tawi) - 180 001, India).

Induction of resistance to bacterial leaf blight (X. oryzae) disease in the high yielding variety Vijaya (IR.8 x T.90)

The high yielding variety Vijaya (IR 8 x T 90), susceptible to bacterial leaf blight (Xanthomonas oryzae, Uyeda and Ishiyama Dawson) was taken up for induction of resistance to bacterial leaf blight disease through EMS treatment.

Dehusked seeds of Vijaya were pre soaked in distilled water for 4 hours and then were subjected to 0.1 and 0.2% EMS for 6 hours. The percentage of seed germination and survival was lower in 0.2% EMS.

Seedlings of M_1 were raised in pots and panicles of individual plants were harvested separately.

The seeds of M_2 (8800 plants) generation were grown in nursery beds and were transplanted in field after 30 days. The plants were inoculated at the boot leaf stage with X. oryzae by clipping method. Observations on lesion length were taken 15 days after inoculation.

The frequency distribution of Vijaya control (untreated) was bimodal while the EMS treated population was polymodal showing the introduction of new peaks. A wider range of variability had been induced towards both resistant and susceptible sides. The percentage of resistant and moderately resistant plants was 0.36 and 0.65 in M_2 generation.

The seeds of resistant (11 plants) and moderately resistant plants (20) of M_2 were sown for M_3 generation. These plants also segregated in the range of 0-31 and 0-32 cm lesion length. The frequency distribution curve was polymodal. The percentage of resistant plants was 1.07 per cent from 'R', of M_2 and 0.42 per cent from 'MR' of M_2 and the percentage of moderately resistant plants was 4.28 from 'R' of M_2 and 3.22 from 'MR' of M_2. Susceptible plants of M_2 also segregated towards resistance (1.15 per cent) and moderately resistant (6.96 per cent) in M_3 generation.

Resistant (25) and moderately resistant (147) plants of M_3 were carried forward to M_4 generation. These plants segregated in the range of 2.1 - 25 cm lesion length. The frequency curve was polymodal. No resistant plant (up to 2.0 cm lesion length) could be isolated in M_4 generation. The percentage of moderately resistant plants was 4.44 per cent from 'R' of M_3 and 4.82 per cent from 'MR' of M_3 and 4.77 per cent from 'S' of M_3 generation.

The yield of resistant plants was low whereas the yield of moderately resistant plants was equal to that of the parent; the yield of susceptible segregants was equal or better than the parent.

(Contributed by S.Y. Padmanabhan, S. Kaur and M. Rao, Central Rice Research Institute, Cuttack - 753 006 (Orissa), India).

Induction of resistance to blast disease (Pyricularia oryzae) in the high yielding variety, Ratna (IR.8 x TKM.6)

The popular high yielding variety, Ratna (IR 8 x TKM 6) with a duration of 110 days is susceptible to blast disease (Pyricularia oryzae). It was táken up for induction of resistance to the disease through EMS treatments.

Dehusked seeds of Ratna were pre-soaked in distilled water for 4 hours and then were subjected to 0.1 and 0.2 % EMS for 6 hours. The percentage of germination was lower in 0.2 % EMS but survival was more.

Seedlings of M_1 were raised in pots and panicles of individual plants were harvested separately for M_2 generation.

The seeds of M_2 generation were grown in "Uniform Blast Nursery" for observing blast disease reaction. The scoring and classification of blast reaction was done as per the method described by Padmanabhan and Ganguly (1959). The seeds of resistant plants were harvested and grown in M_3 generation. Few susceptible plants were also carried forward to M_3 generation.

Ratna control (untreated) developed "B", "C" and "D" type of spots. In addition to these classes, the EMS treated population (8000 plants) developed "O", "A" as well as "E" type of spots, showing a wider range of variability than the untreated control, towards both resistance and susceptibility.

Three hundred resistant plants (with "O", "A" and "B" type of spots) from M_2 were carried forward to M_3 generation. These also segregated giving a range of reaction from O-E spots as in the case of M_2 (where as control reaction was restricted to "B", "C" and "D" spots). The population of resistant plants was higher in M_3 (31.65%) than in M_2 (23.6%).

The progenies of a few plants (50 plants) found susceptible in M_2 also segregated in M_3 towards resistance, but the percentage of resistant plants was low (7.6%).

(Contributed by S. Kaur, S.Y. Padmanabhan and M. Rao, Central Rice Research Institute, Cuttack, India).

Type of infection, severity and tolerance to Puccinia recondita tritici in old mutant lines of wheat

Testing of old mutant lines (M_{12} and M_{13} generations) derived from cultivar San Pastore after treatment by gamma rays, revealed that genetic variability for leaf rust resistance exists within and between mutant lines. The resistance was expressed in lower severity, type of infection and modification of tolerance.

The correlation between severity, tolerance and type of infection was very weak, therefore separate selection for each of these components was applied.

The mutant lines respond to selection for the type of infection O-1 and O/4 with severity T-10% and we were able to select progenies which were different from the control. The mutant lines did not respond to selection in tolerance. Studies of the pedigrees of the mutant lines indicate that the primary mutational changes occured in M_3 and M_4 generations.

(Contributed by Katarina Borojević, Department of Genetics and Plant Breeding, Faculty of Agriculture, University of Novi Sad, Yugoslavia).

Studies on recombination between alleles in the ml-o locus in barley and pleiotropic effects of the alleles

Ten barley (*Hordeum vulgare*) mutants induced by mutagenic treatments and a barley line from Ethiopia have recessive, functionally allelic genes in the *ml-o* locus conditioning resistance to the powdery mildew fungus (*Erysiphe graminis* f.sp. *hordei*). The 11 genes are designated *ml-o* 1 through *ml-o* 11.

In order to study the structural allelism of some *ml-o* genes, four mutants and the Ethiopian barley line were intercrossed. The F_1 plants (heteroallelic genotypes) and plants of the five parents (homoallelic genotypes) were grown carefully isolated from outcrossing. Screening of the progeny with powdery mildew revealed a few susceptible (recombinant) plants in the F_2 populations. The progeny of the parents were all resistant. This suggests that some of the *ml-o* genes have mutations in different sites within the *ml-o* locus. These results encouraged us to initiate a recombination experiment with six selected *ml-o* alleles in lines carrying genetic markers, where contaminants from admixture or outcrossing can be distinguished from recombinants. This experiment may (1) enable a mapping of mutational sites within the ml-o locus, (2) confirm the hypothesis that the ml-o resistance genes are point mutations and not deficiencies, and (3) confirm that the "pleiotropic" effects of the ml-o alleles are due to true pleiotropism and not to closely linked genes.

The ml-o resistant mutants have necrotic/chlorotic flecking on the leaves and reduced grain yield that appear to be pleiotropic effects of the resistance genes. The phenotype of the leaf-flecking is characteristic of the mutants from each mother variety, and it alters when the genetic background is altered. Material from about 1700 resistant F_3 plants from eight crosses was subjected to recurrent selection in F_3, F_4 and F_5. About five F_5 lines appear to be without leaf-flecking. This indicates that the pleiotropic effects of the ml-o resistance genes can be modified. An experiment initiated in 1974 aims at elucidating (1) whether three selected ml-o alleles have the same or different pleiotropic effects, (2) whether the modification of the pleiotropic effects is conditioned by single modifier genes or by the general genetic background, and (3) the possible interaction between the ml-o alleles and the modifying genes.

(Contributed by J. Helms Jørgensen, Danish Atomic Energy Commission Research Establishment Risø, DK-4000 Roskilde, Denmark).

Search for rust resistant mutants in oats

In 1972 a total of about two million M_2 plants were grown at Morden, Manitoba. Thirteen plants which were thought to have possible resistance to race C10 of oat stem rust were harvested. After extensive seedling and adult plant rust tests the best of the selected plant progenies was crossed and backcrossed to Rodney O a stem rust susceptible oat. The resistance in this line M-72-6 was found to be controlled by a single gene.

Unfortunately all resistant plants were found to be dwarf like the original mutant with a very weak crown root system which allowed the plants to fall over soon after heading. All plants with resistance had tissue that appeared to senesce early. The resistance may be an anomaly which is related to the early senescence of the plant tissue.

In 1973 another two million M_2 plants were examined for rust resistance at Morden and 38 were harvested. None of the M_2 plants selected in 1973 appeared to have any seedling or adult resistance when examined more thoroughly in the greenhouse and again in the field in 1974.

In 1974 one million M_2 plants were examined for resistance and 73 selected. None appeared to have any resistance when tested further.

The strain CI3034 which has good adult plant stem rust resistance associated with weak straw and a light green plant color were treated with gamma radiation and EMS in 1973 and the M2 grown in the C10 rust nursery at Morden in 1974.

A considerable number of dark green plants were present in all treatments but unfortunately all were found to be stem rust susceptible. Thus it would appear to be difficult if not impossible to separate the rust resistance in CI3034 from the undesirable characters, weak straw and light green plant color.

Lack of success in obtaining new and useful stem rust resistant mutants by traditional methods has been discouraging. The failure to find good rust resistant mutants among a population of about five million M_2 plants doesn't prove there were none there. However, five experienced rust workers were involved in the screening each year and any reasonable frequency of mutants should have been observed. We must either conclude that for some reason no rust resistant mutants were present or that the frequency was very low and any resistant plants were overlooked.

(Contributed by R.I.H. McKenzie, J.W. Martens and D.E. Harder, Canada Agriculture Research Station, Winnipeg, Manitoba R3T 2M9).

Sensitivity of developmental stages of peanut (A. hypogaea) embryos and ovaries to several chemical mutagen treatments

Peanut embryos at successive stages of development were treated while still attached to the parent plant with the mutagen DES, EMS, MNNG, ICR-170, acriflavine, ethidium bromide, hydroxylamine, nitrous acid and sodium azide, and with the protein synthesis inhibitors chloramphenicol and erythromycine, for periods varying from two hr to 15 days. The results show that chronic treatments of fertilized ovaries with chemical mutagens are possible. However, differences in sensitivity were found between the stages of development of the embryos, with the earlier stages being the most sensitive. The alkylating agents were the most injurious while the acridines (ethidium bromide, ICR-170 and especially acriflavine) caused little damage as measured by the survival of the treated embryos and their subsequent germination. Within the mutagens, especially in treatments lasting more than 24 hr, the concentration of the mutagen during the treatment was the most important factor affecting the survival of the treated embryos. In the short treatments, the duration was as important as the concentration. Treatments of young embryos with chemical mutagens could be valuable in crops whose ovaries contain many ovules, because of the large M_1 seed populations obtainable from each fruit.

In investigations now in progress, the spectra of mutations obtained from EMS treatments of developing embryos, differed from those obtained from mature seed treatments. Furthermore, the mutant sectors obtained following the embryo treatments were bigger. These results emphasize the advantage of mutagenic treatments of young embryos. Embryo treatments could be specially valuable in plants whose ovaries contain many ovules such as in tobacco, tomatoes, sesame and cucumbers. It would then be possible to treat easily large populations of young embryos and to obtain large M_1 populations.

(Contributed by A. Ashri and A. Levy, Faculty of Agriculture, The Hebrew University, Rehovot, Israel).

Significance of adventitious bud techniques in vivo and in vitro for mutation breeding in Chrysanthemum

In vivo adventitious buds produced on detached irradiated leaves of Chrysanthemum morifolium Ram. cv. "Bravo", proved to be of a chimeral nature in the majority of cases. They developed on callus, obviously from more than one cell, formed at the base of the petiole.

Via *in vitro* culture 1300 flowering plants of the cultivar "Bravo" were obtained, which originated from explants of the leaf, the pedicel and the capitulum. Before incubation the explants were irradiated with different doses of X-rays, ranging from 0-2000 rad, to determine the radiosensitivity, the mutation frequency and thus the optimum dose. The results can be summarized as follows: Pedicel-segments regenerated the highest number of adventitious shoots and, moreover, they developed faster as compared to young flower heads or leaves. The mutants produced by irradiating the various explants were almost exclusively of a solid, non-chimeral nature. In addition, histological observations suggested that single epidermal cells were involved in the initiation of the adventitious shoots on pedicel-explants. The optimum dose for mutant production was approximately 800 rad X-rays. Rather often, more than one phenotypically identical mutant was found, which always was derived from the same explant. They probably originated from a multi-apical meristem formed by a single mutated cell.

(Contributed by C. Broertjes, S. Roest and G.S. Bokelmann, Institute of Atomic Sciences in Agriculture, Wageningen, The Netherlands).

Release of mutant variety of raya (Brassica juncea)

Raya (Brassica juncea Coss.) is an important oil seed crop of the Punjab. The presently grown variety RL18 was released for cultivation in 1937. The Variety Approval Committee of Punjab has now approved a new raya variety named RLM-198 for cultivation under high fertility, irrigated conditions. The new variety has been developed from irradiated seeds of RL18. The main distinguishing features are dark green, smooth and broad leaves with profuse branching. It has longer shoots with heavy pod bearing. It has dark brown bold seeds with higher oil content. It matures 5-6 days later than RL18. It shows moderate resistance to aphid and leaf miner. It yielded 1314 kg/ha against 1224 kg/ha for RL18 (mean of 52 trials on research stations, governmental seed farms and farmers fields). Under research station condition, its yield was nearly 25% higher than that of RL18.

Table: Comparative performance of RLM198 and RL18

Character	RLM198	RL18
Plant height	192,3	192,2
No. of primary branches per plant	10,8	9,2
No. of secondary branches per plant	38,3	29,7
Main shoot length (cm)	74,1	60,6
No. of pods on main shoot	56,6	40,9
Pod length	3,8	3,6
1000-grain weight	2,9	2,6
Oil content %	39,1	37,5
Days taken to flowering	72,5	66,5
Days taken to maturity	153,5	148,5
Yield 1971-75 at P.A.U. Research Station (mean, kg/ha)	1911	1530

(Contributed by K.S. Lobana, Department of Plant Breeding, Punjab Agricultural University, Ludhiana).

LIST OF MUTANT VARIETIES

The Plant Breeding and Genetics Section of the Joint FAO/IAEA Division undertakes the collection and dissemination of information on commercially used agricultural and horticultural varieties developed through the utilization of induced mutations. This list does not claim to be comprehensive. Its content is strictly based on information transmitted by the breeders themselves and/or other institutions involved. Listing of a variety does not imply its recommendation by FAO/IAEA.

Name of new variety	Place and date of release (or approval) and name of principal worker and institute	Kind and date of mutagenic treatment/cross (parent variety)	Main improved attributes of variety
RYE			
Hankkija's Jussi (Hja 6900)	Finland 1975 E. Varis Hankkija Plant Breeding Inst., Hyrylä	10 krad ^{60}Co gamma-rays [Vjatka]	Good winter hardiness, short stiff straw, good quality
BARLEY			
Rupal	Sweden 1972 Swedish Seed Association Svalöv	Pallas (mutant) x Rupee	Short straw, mildew resistant, sprouting resistant
Eva	Sweden 1972 Swedish Seed Association Svalöv	Mari x Birgitta	Straw stiff, early maturing in northern Sweden, high seed production and large kernels
Senat	Sweden 1974 Swedish Seed Association Svalöv	Pallas (mutant) x Hellas x "triple-aron lemma"	Straw stiff, sprouting resistant
Salve	Sweden 1974 Swedish Seed Association Svalöv	Mari x Birgitta	Large, plump kernels, stiff straw and high seed production, good field tolerance to mildew

Name of new variety	Place and date of release (or approval) and name of principal worker and institute	Kind and date of mutagenic treatment/cross (parent variety)	Main improved attributes of variety
BARLEY (continued)			
Hankkija's Aapo (Hja 4003)	Finland 1975 E.I. Kivi and M. Rekunen Hankkija Plant Breeding Inst., Hyrylä	X-rays 1961 [Ta 7990 (a 4615 x Staller II)]	Two row fodder barley, very stiff, short straw, high tillering capacity, high yielding ability
Hankkija's Eero (Hja 4715)	Finland 1975 E.I. Kivi and M. Rekunen Hankkija Plant Breeding Inst., Hyrylä	Mari (mutant) x Otra (six rowed)	Six row fodder barley, very stiff, also in northern latitudes short straw
MUSTARD (Brassica juncea)			
RLM 198	Punjab (India) 1975 K.S. Lobana	irradiation [RL 18]	Increased oil content and yield, about 5-6 days later maturing compared to parent variety RL-18
PEANUT			
Colorado Irradiado	Argentina J. Pietrarelli INTA, Exp. Station Manfredi, Prov. Cordoba	X-rays 20 kr 1964 [Colorado de Cordoba]	Higher yield, higher oil content
ANTIRRHINUM			
Antirrhinum Juliva	1961 FRG E. Knapp, Rosenhof Julius Wagner Heidelberg	Cross with X-ray induced mutant A. Divaricata	Altered flower morphology

Name of new variety	Place and date of release (or approval) and name of principal worker and institute	Kind and date of mutagenic treatment/cross (parent variety)	Main improved attributes of variety
ANTIRRHINUM (continued)			
Bright Butterflies	1966 G.A. Goldsmith Gilroy, California (USA)	Cross with X-ray induced mutant A. divaricata	Altered flower morphology
Madame Butterfly	1966 G.A. Goldsmith Gilroy, California (USA)	Cross with X-ray induced mutant A. divaricata	Altered flower morphology
Little Darling	1966 G.A. Goldsmith Gilroy, California (USA)	Cross with X-ray induced mutant A. divaricata	Altered flower morphology
ROSE			
Permoser	DDR 1970 VEG Saatzucht Baumschulen Dresden	1500r buds [Kordes Perfecta]	More intense color of petal margin, otherwise like parent
BEGONIA			
Turo	Netherlands 1973 J. Doorenbos Dept. of Horticulture Agric. University Wageningen	Leaf irradiation 1500–2500 rad X-rays [clone Le 1, from F_1 of cross B. Bertinii compacta "Leuchtfeuer" x B. socotrana]	Flowers more vivid
Tiara	Netherlands 1974 J. Doorenbos Dept. of Horticulture Agric. University Wageningen	Leaf irradiation [clone So 1, from F_1 of cross B. Bertinii compacta "Sonnenschein" x B. socotrana]	Yellow flowering

Name of new variety	Place and date of release (or approval) and name of principal worker and institute	Kind and date of mutagenic treatment/cross (parent variety)	Main improved attributes of variety
		CORRECTION	
DURUM WHEAT			
Creso instead of Cresco			

NOTE: Readers are kindly requested to report to us any information about commercial mutant varieties including varieties which have induced mutants in their pedigree. Of particular interest is information about the commercial value of such varieties (acreage covered, amount of certified seeds produced, date of withdrawal from commercial production).

ANNOUNCEMENT

FAO and IAEA are jointly planning to organize in 1977 an International Symposium on the Use of Induced Mutations for Improving Disease Resistance in Crop Plants. The symposium should provide the opportunity to review achievements and failures of projects aimed at inducing mutants for vertical or horizontal resistance, for field resistance or tolerance, for immunity or hypersensitivity. Among the topics of the symposium should also be screening techniques for various types of resistance under field, greenhouse or test tube conditions, means of and equipment for inoculation, handling of virus transmitting insects, and other methodological questions including the management of resistant varieties. It would certainly also be valuable to discuss mechanisms of resistance and means for their identification and genetic manipulation. Last, but not least, the subject of gene and allel erosion should be reviewed with the view to replenish losses by induced mutants.

Although date and location have not yet been determined, we would like to have names and addresses of those interested in the symposium so that we could contact them directly and provide further information.

FUTURE EVENTS OF INTEREST

1976

Third INTSOY Regional Soybean Conference, Chiang Mai (Thailand), 23-26 February 1976.

International Symposium on Genetic Control of Diversity in Plants, Lahore (Pakistan), 1-7 March 1976.

Second FAO/IAEA Research Coordination Meeting on Improvement of Vegetatively Propagated Crops and Tree Crops through Induced Mutations, Wageningen (Netherlands), 16-22 May 1976.

Meeting of the EUCARPIA, Section Mutations and Polyploidy, Novi Sad (Yugoslavia), 7-10 June 1976.

Third FAO/IAEA Research Coordination Meeting on the Improvement of Mutation Breeding Techniques, Pullman, Washington (USA), July 1976.

Third John Innes Symposium "Structure - Function Relationships of Proteins", Norwich (UK), 19-22 July 1976.

Fourth International Symposium on Tropical Root Crops, Cali, Colombia, 1-8 August 1976.

Fourth European and Mediterranean Cereal Rusts Conference, Interlaken (Switzerland), 5-10 September 1976.

EPPO Conference Plant Protection in Modern Society, Paris (France), 23 September 1976.

EPPO Conference on Systems Modelling in Modern Crop Protection, Paris (France), 12-14 October 1976.

Second FAO/IAEA/SIDA Training Course on Plant Breeding for Disease Resistance, including the Use of Induced Mutation Techniques. Date and Location not yet determined.

International Symposium on Coconut Research and Development, Central Plantation Crops Research Institute, Kasaragod, Kerala (India), 28-30 December 1976.

1977

Regional Seminar on Improvement of Rice Production through Research Using Nuclear Techniques. Location tentatively Djakarta (Indonesia), date not yet determined.

FAO/IAEA Symposium on the Use of Induced Mutations for Improving Disease Resistance in Crop Plants (date and location not yet determined).

Third Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO), Canberra (Australia). Date not yet known.

RECENT PUBLICATIONS

Breeding for Seed Protein Improvement using Nuclear Techniques. Proceedings of a Research Coordination Meeting held at Ibadan (Nigeria) 1973. IAEA, STI/PUB/400, 1975, US$14.00.

Improvement of Vegetatively Propagated Plants through Induced Mutations. Proceedings of a Research Coordination Meeting, Tokai (Japan), 1974.
IAEA-173, Vienna 1975
(Available as microfiche copy on prepayment of US$0.65).

Tracer Techniques for Plant Breeding. Proceedings of a Panel, Vienna (Austria) 1974.
IAEA, STI/PUB/419, US$7.00.

REQUEST

Induced dwarf mutants in rice

A major limitation of the dwarf, high yielding rice varieties is that all of them derive their dwarf plant type from a single dwarfing gene from variety Dee-Geo-Woo-Gen. Considering that this creates a risk in terms of genetic vulnerability, and that a large number of dwarf and semi-dwarf mutants have been obtained in induced mutation experiments, the Joint FAO/IAEA Division is considering to initiate a cooperative research effort to identify and make available other genetic sources for short plant type in rice. Many institutions may have such mutants which, though not suitable for direct cultivation, could be useful in crossing programs. We would appreciate receiving information on the induced dwarf mutants available at different places. Please indicate their approximate yield levels, relative to the parent cultivar or a standard check like IR-8. Any genetic studies made with these mutants may also be indicated.

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LAST, BUT NOT LEAST

Please submit your contributions to the Newsletter by 1 June and 1 December of each year.

Authors are kindly requested to take into account that the readers want to learn about new findings and new methods but would also like to see the most relevant data on which statements and conclusions are based. Conclusions should be precise and distinguish facts from speculation. The length of contributions should not exceed 2-3 typewritten pages including tables. We regret that photographs cannot be accepted for technical reasons. References to publications containing a more detailed description of methods or evaluation of findings, are welcome but should generally be limited to one or two.

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