Genetic amelioration of local Basmati rice through induced mutagenesis

Present investigation was undertaken to study the nature and magnitude of induced variation for grain yield and other morpho-physiological traits, the spectrum and frequency of mutations and to isolate and characterize dwarf and other desirable mutants in EMS (0.8%, 1.0% and 1.2%) treated and gamma-rays (25-30 kR and 35 kR) irradiated populations of local Basmati cultivar T-23. Regarding the spectrum of phyll mutations, the relative percentage of albina and xantha was more in the EMS treated population as compared to the gamma-irradiated ones. The frequency of induced mutations was higher when calculated on the family as compared to the M2 plant basis. Lower doses of the chemical (0.8%) and the physical (25 kR) agents were found to be more effective and efficient. EMS, in general, was found to be more efficient but effective than gamma-rays on the basis of percent post-germination lethality and sterility. Analysis of variance revealed the induction of sufficient genetic variability for all the traits studied in the M2 and M3 generations. The estimates of PCV, GCV, heritability (broad sense) and genetic advance were high for grain yield/plant, number of grains/panicle and effective tillers/plant in different treatments of the chemical and physical mutagens in the M2 and M3 generations. The doses of gamma-rays were found to have linear relationship with the magnitude of PCV and GCV, whereas in the EMS treatments, the magnitude of these mates was the maximum in 1.0% EMS. In comparison to EMS, gamma-rays were found to be less effective in generating polygenic variation in terms of coefficient of variability. Heritability and genetic advance were observed in the intermediate doses of EMS (1.0%) and gamma-rays (30 kR) in both the M2 and M3 generations. In EMS treatments, significant additive and dominance effects along with over dominance were observed for grain yield/plant in 1.0%, panicle length in 1.2% and number of grains/panicle in all the treatments. Similarly, the gamma-rays treatments, significantly positive additive and dominance effects along with over dominance were observed for panicle length, number of grains/panicle and plant height under 35 kR and also for grain yield/plant in all the doses of gamma-rays. Presence of over dominance for grain yield and its contributing traits other indicates that selection aimed at improving local Basmati cultivar T-23 productivity through mutation breeding has to be deferred to later generations. The shifts in mean, in general, were unpredictable and depended upon the traits studied and dose applied. Mutant progenies, viz., TM-7, TM-13, TM-17 and TM-23, were found to be superior for grain yield, panicle length and effective tillers/plant, whereas TM-38, TM-39, 4-41, TM-42 were dwarf, early maturing with long slender fine grains. In addition, TM-3, TM-24, TM-27, 4-28 and TM-31 were found to have more protein, while two moderately blast resistant mutants, viz., TM-25 and TM-26, were also obtained. All these mutants can be used for the development of high-yielding, semi-dwarf, early maturing varieties with higher protein content in scented rice for the mid-hill conditions of north western Himalayas.