Induction of a new genetic variability in Moroccan sesame by mutagenesis

Mohamed Kouighat[1.2]. Hafida Hanine[2]. Mohamed El Fechtali[1]. Abdelghani Nabloussi[1]

1 Institut National de la Recherche Agronomique. Regional Agricultural Research Center of Meknes. Meknes. Morocco

2 Université Sultan Moulay Slimane. Faculty of Science and Technics. Department of Biology. Beni Mellal. Morocco

Abstract

Sesame is an ancient oilseed plant with important agronomic, therapeutic, and industrial properties. Moroccan sesame is characterized by low productivity due to wild traits. To overwork, such wild characters, genetic improvement of plants is necessary. However, in Morocco, the existing genetic diversity is limited. Thus, chemical mutagenesis, using ethyl methanesulfonate (EMS), has been applied to induce new genetic variability. Seeds of two sesame genotypes were treated for five hours using two concentrations of EMS, 0.5% and 1%. Some mutant plants (M1) were identified and characterized. Specifically, mutants with a tetra-carpelate capsule, three capsules per leaf axil, determinate growth, various seed colors, and a highly developed root system have shown promise and utility for the sesame breeding program aimed at developing productive and high-quality cultivars, especially for stressful environments.

Introduction

Sesame (*Sesamum indicum* L.) is an oleaginous and aromatic plant that has important agronomic, therapeutic and industrial interests. It has been cultivated for centuries across the world, mainly in parts of Asia and Africa. In Morocco, its average production is very low (around 1800 t / year). This yield remains low due to several constraints, such as the lack of improved cultivars, drought and the use of traditional production techniques. In addition, sesame still exhibits wilder characters, including capsule dehiscence, indeterminate plant growth and asynchronous maturation, leading to very low seed yield. The varietal selection remains the only way to overcome most of these constraints. To do this, a large genetic variability must be available. However, very low and limited genetic diversity has been reported in Moroccan sesame cultivars. Therefore, there is a need to expand the existing genetic variability for breeding purposes. It is in this context, chemical mutagenesis, using Ethyl Methane Sulfonate (EMS), has been used successfully to obtain additional variability in some sesame germplasms cultivated in Morocco.

Materials and methods

Plant material

Sesame seeds of two wild parents ML13 and US06

Induction of variability

Chemical mutagenesis by EMS at 0,5 ant 1%

Plants characterization

M1 population obtained was characterized

Traits evaluated

Morphological and agronomical traits.

Compared to parents with bi-carpel capsules and one capsule per leaf axil, two mutants having, respectively, multi-carpel capsules (Figure 2) and several capsules per leaf axil (Figure 3) were obtained, thus exhibiting good and valuable agronomic characteristics.

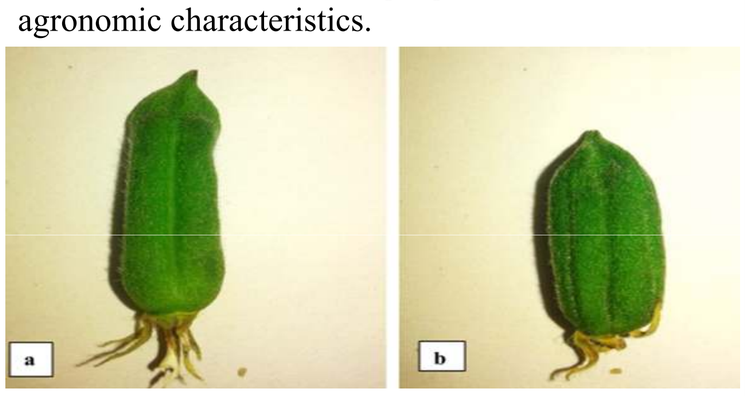

Figure 2. Number of carpels per capsule, (a) bi-carpellate capsule in the check cultivar US06 and (b) tetra-carpellate capsule in the mutant US2-7.

Figure 3. Number of capsules per leaf axil in sesame, (a) three capsules per axial in the mutant ML2-68 and (b) a single capsule in the wild type variety ML13.

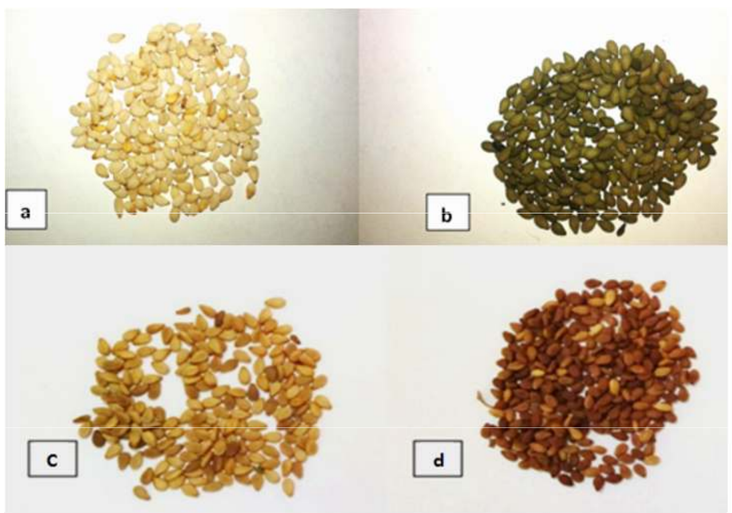

Figure 4. Pigmentation of seed coat: (a) White seeds of the wild cultivar US06, (b) pale black seeds of the mutant US2-6, (c) light brown seeds of the wild cultivar ML13, (d) and dark brown seeds of the mutant ML2- 12.

Results and discussion

Overall, great genetic variability was obtained. After the characterization of the M1 population was obtained, a sesame mutant with a determined growth mode was observed and isolated (Figure 1).

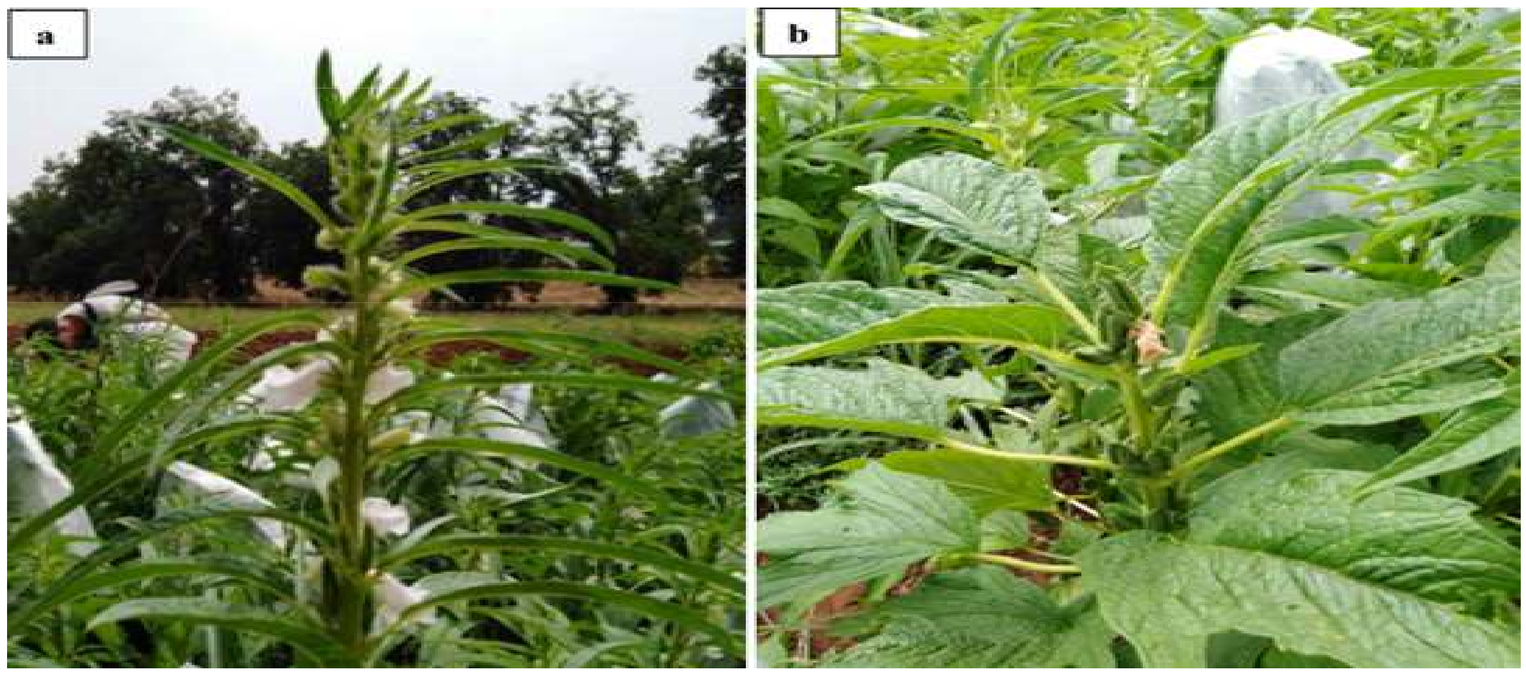

Figure 1. Growth habit in sesame plants studied: (a) indeterminate growth of the parent US06, (b) determined growth of the mutant US1-5.

The Mutagenesis has also induced a variation in the pigmentation of the seed coat. A pale black color was observed in the seed coat of the "US2-6" mutant and dark brown coloration of the seed coat was recorded in the "ML2-12" mutant (Figure 5). The variation of the seed coat of sesame is related to the chemical and biochemical composition of the seed. Therefore, the mutants obtained would be useful for improving certain physiological, nutritional, industrial and medicinal properties of Moroccan sesame (Figure 4).

Conclusion

Chemical mutagenesis by EMS has made it possible to induce new genetic variability. Thus, viable and interesting mutants of sesame from the morphological and agronomic points of view have been characterized. The resulting mutants could serve as useful germplasm for the sesame breeding and breeding program in Morocco..