tions on male plants will be a valid method of selecting them for breeding purposes.

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Radiation-induced Sex Reversal in *Ecballium elaterium*

Galan[1,2], whose work was reviewed by Mather[3], showed that the cucurbitous plant *Ecballium elaterium* has been shown to exhibit the simplest sex-determining mechanism ever found in higher plants. A dioecious variety growing in the south of Spain and in North Africa maintains a 50 per cent pro-sex ratio in Nature by means of a pair of alleles $a^D > a^d$. Male plants are heterozygous while female ones are recessive. On the other hand, the well-known monoecious variety which grows in Mediterranean Europe is homozygous in a third allele a^+. Through reciprocal hybridization between both varieties, Galan was able to demonstrate that allele a^+ dominates a^d, but behaves as a recessive factor in relation to a^D.

During the past three years we have attempted to induce mutations in the allelic series $a^D > a^+ > a^d$, especially in the two alleles which are involved in the dioecious variety. Gamma rays, neutrons and diethyl sulphate (DES) have been used as mutagenic agents. Our tests in the first year recommended a dose of approximately 20,000 rads of ionizing radiation for treatment of dry seeds. DES was used at a concentration of 1/500 during 24 h. Chronic gamma irradiation of growing plants was also carried out with dose rates ranging from 10 to 120 rads per day. Neutron exposures were delivered at the J.E.N. nuclear reactor of La Moncloa (Madrid) while gamma rays were provided by our own gamma facility ('El Encin', Alcalá de Henares) equipped with a 2,250-c. $Cs^{-137}Ba$ source.

However chronic or acute was the treatment, notes were only taken of the actually irradiated generation (R_1), since it can easily be learned that mutations $a^D \rightleftharpoons a^d$ in any direction would show up readily from genotypes as $a^D a^d$ or $a^d a^d$, with no need for back-crossing. Nearly 2,000 mature individuals were observed in each of their branches, for in irradiated seeds an induced mutation would normally affect a single cell in the embryo, and it would only appear partially in the adult plant.

In the course of three seasons we have been able to observe a number of sex aberrations which were clearly not mutations but probably originated from disturbances in the mechanisms concerned in sex phenotypic expression. Some new characters not affecting sex also appeared, a few of them probably genetic changes. These are now being observed for a future tentative list of mutable genes in this interesting plant species.

Late in summer 1964, one instance of a sex reversal with a high probability of being of genetic origin, was detected in a masculine plant of the dioecious variety, arising from a neutron-irradiated seed. It consisted of a complete reversal to morphologically quite normal female flowers, affecting one of the lower branches of the plant; moreover, it did not involve the whole branch but certain nodes of it. After a detailed phyllotactic map was built, the new character appeared to be distributed clearly in a sector of approximately 180 degrees. Sectoriality strongly suggests that we are dealing with a mutation, at least in the wider sense of this word that includes chromosome deletions or re-arrangements.

No other character was observed to change in association with the flower sex. Leaf and stem colour, leaf shape, hair pattern, etc., were unaltered. Curiously, it was the fact that while flower morphogenesis reached a quite reversed expression, the aspect of the inflorescence remained essentially masculine. In the leaf axil of a male plant of *E. elaterium* var. *dioicum*, the inflorescence is elongated and bears up to 15–20 flowers successively during the season (see Fig. 1, upper left); the first of these flowers originates from a different primordium and bears no bract, though its peduncle is largely connated to the inflorescence axis[4]. This first flower is the only one which develops in the axil of female plants, of course with a female expression[4]. In this case, after fecundation, the stalk thickens and elongates rapidly, with a marked negative geotropism (upper right); the fruit at its top explodes later by the well-known hydraulic seed dispersal mechanism of this species. On our mutated branch, female flowers were found not only in the axil, but also rather clustering along non-thickened, non-geotropic axes (lower figure, on the right).

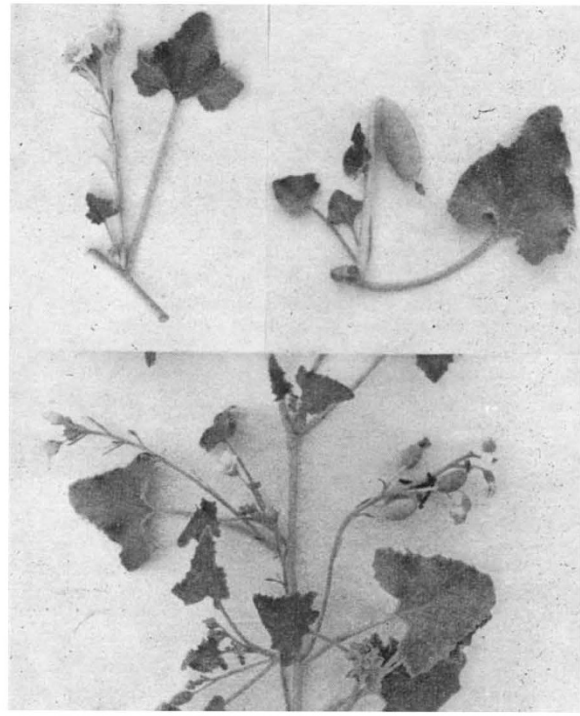

Fig. 1

Unfortunately, female flowers of the reversed branch yielded only three or four poor-looking seeds which would probably be unable to germinate, and in any case would not provide enough information on sex proportions in the R_2. Many of these flowers gave rise to well-developed though seedless fruits, or in other words, to parthenocarpic fruits. The observed sterility may be the consequence of an induced chromosome aberration, perhaps a deletion involving gene a^D. Lack of apparent side effects on the phenotype would seem to indicate that the hypothetical chromosomal damage is not too drastic. The possibility still remains of a mutation $a^D \rightarrow a^d$ where the female genotype loses most of its fertility within a 'male environment'.

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