

self-pollinated. Eight irradiations of *Lamarckiana* and four of *franciscana* were made, the tubes of radon used varying from 7 millicuries to 17 mc, and the times of application from four to twenty hours. At the same time, flowers on another shoot of the same plant were selfed (being adequately protected by lead) to provide control material. In all cases, control families have shown only the usual species characteristics.

The immediate effects of the radium treatment were a development after two days or less of a necrotic area in the cluster where the radon tube had rested, an abscission of buds thus affected regardless of size or age unless the injury was very slight, and a necrosis of all buds in the stages of meiosis or younger. The rate of flowering, the size of the flowers, and the fertility, chiefly of the pollen, were affected to a greater or less degree depending on the dosage.

Single capsule sowings were made in 1930 of the seed from treated buds, making 95 families of *Lamarckiana* origin and 29 families of *franciscana* origin. The percentage germination was lowered in those cultures which had the heavier dosages. As the seedlings developed their rosette characters it was found that many unclassifiable leaf shapes, sizes and peculiarities existed in both *Lamarckiana* and *franciscana*. In the majority of cases, the leaves were very much distorted and retarded in growth. In some cases, however, quite new and distinct leaf features were present. In *Lamarckiana* material small, weak plants were rather common in irradiated cultures, some with very unusual leaf characters; mottled, pale green, reduced size, wiry, irregular, no crinkling, excessive crinkling and the like. No two were identical. In the *franciscana* cultures the same general conditions were present, although the percentage of abnormal forms was lower. However, the most striking of the radium variants have been in *franciscana* material.

It is unfortunate that the vast majority of the atypical forms mentioned above were too weak to survive field conditions, either dying or not coming into bloom. A few of the stronger ones did bloom, however, and have proved very interesting plants. The abnormal characteristics manifest in the rosette condition continued and new ones peculiar to the mature condition appeared. As a rule, the flowering tip was smaller, bore fewer flowers, and had quite a high percentage of buds drop before blooming. The flowers were generally smaller, distorted in most features, and pollen sterility was much in evidence. Some few plants were wholly sterile.

Breeding work, in so far as was possible, was done with the above forms. The progenies are now being grown. It is known definitely that one of the abnormal types found in *Lamarckiana* when selfed throws

a progeny in which the parent type composes approximately one-fourth (7 in 27) of the population. This type is a little more viable than the majority. It is a form with dull coarse leaves, free from crinkling with very irregular margins, sometimes toothed. The behavior at present suggests some unbalanced chromosome condition.

One of the more viable of the atypical *franciscana* forms was selfed and its progeny grown this summer. An entirely new form has appeared, extremely weak with very linear mottled leaves. Twenty-three of these plants have appeared in a population of 64, the frequency suggesting a 1:2 ratio. It is disappointing that this new form is not viable under field conditions. Selfings are being made among the 41 other plants in the hope of discovering a few heterozygotes which will give the same form next year.

Many of the normal plants in irradiated cultures were selfed in the summer of 1930, so that any recessive condition induced by radium treatment might appear in their progeny this summer. In one case, that of a *franciscana* plant, an abnormal type has appeared. In a population of 25 plants, four are of this new type, characterized chiefly by the tiny, much distorted crinkled condition of the leaves on the flowering tip.

It is intended to continue the genetical investigation on these new forms occurring in the progenies from radium-treated buds, in so far as the conditions of reduced fertility will permit. It is also planned to investigate the chromosomal conditions in the radium variants.

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## BOOKS RECEIVED

- BINET-SANGLE, DOCTEUR. *Les Ancêtres de l'Homme*. Pp. xx+290. 16 photographs. Michel. Paris. 25 francs.
- CAMPBELL, GEORGE A. and RONALD M. FOSTER. *Fourier Integrals for Practical Applications*. Pp. 177. 7 figures. Bell Telephone Laboratories.
- DITMARS, RAYMOND L. *Snakes of the World*. Pp. xi+207. 84 plates. Macmillan. \$6.00.
- HALE, GEORGE E. *Signals from the Stars*. Pp. xx+138. Illustrated. Scribner's Sons. \$2.00.
- MAXWELL, JAMES CLERK. *A Commemoration Volume. 1831-1931*. Pp. viii+146. 2 portraits. Macmillan. \$2.50.
- NEW YORK COMMISSION ON VENTILATION. *School Ventilation: Principles and Practices*. Pp. ix+73. Teachers College, Columbia University. \$1.00.
- ROBINSON, HOWARD. *Bayle the Sceptic*. Pp. x+334. Illustrated. Columbia University Press. \$4.25.