

mention cases of recessive dwarf mutations. Gene mutations resulting in various kinds of sterility have also been observed. Terao (1917, 1921), Kondo and Ono (1923), and Nagai (1926) record cases of complete or partial sterile mutants in rice. Terao (1922) mentions also a case of a 'large-grain' mutant from a common race of paddy.

During the rice season of 1931, I noted in the seedling stage after transplanting the appearance of three variant plants in a paddy culture of hybrid origin. These three plants were conspicuous by their short, compact, bushy growth and brevi-foliolate appearance, while the remainder were tall with characteristic morphological features of an ordinary rice plant. Both the parents of the culture are normal tall plants with long leaves, and during the last eight years that the culture has gone through, no such off-type plants were ever observed.

These three plants, believed to have originated by mutation in the preceding generation, are characterised by shortened internodes, the culms ranging from 52 cm. to 60 cm. in height, in contrast to the average of 124 cm. of normal plants. The leaves are much reduced in length, but there is no corresponding reduction in breadth, as both the new type and normals show the same range. The spikelets showed normal development, and though anthesis occurred, the anthers completely failed to burst. As a result, the panicles were entirely sterile. This indicates that the mutated gene has also fatally affected the male gametes. One of the mutant plants was crossed with pollen from a normal plant from the same culture, and some seeds have been obtained. Apparently, the female gametes are functional. The inheritance of this abnormality is under investigation.

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<sup>1</sup> Matsuura, H., "A Bibliographical Monograph on Plant Genetics (Genic-Analysis)", 1900-1925, pp. xi+497. (Tokyo: Imperial University, 1929.)

#### Fatuoids or False Wild Oats

IN a study of the segregates of a cross made between the tetraploid species *Avena barbata* and the diploid species *A. brevis*, certain points of interest have emerged concerning the behaviour of the characters which in the hexaploid species *Avena sativa* constitute the fatuoid complex. In the latter species, when a fatuoid is crossed with normal or cultivated type of grain the fatuoid complex behaves as a partial recessive and in inheritance gives simple Mendelian segregation; there is no break-up of the complex, and no crossing-over takes place. In the *Avena barbata-Avena brevis* cross, however, these same associated characters, of articulation, basal pubescence, and awn, behave in the  $F_1$  as partial dominants, particularly so in respect of the character of the articulation of the grain. Moreover, in the later generations there is a break-up of the fatuoid complex, and cross-over types are produced. Segregates have appeared in this cross in which the basal articulation and basal pubescence characters of the *A. barbata* parent occur in association with the awn and grain-apex of *A. brevis* type, and conversely segregates with typical *A. barbata* awns and the glabrous and normal or solidified base of *A. brevis*.

Chromosome counts in the root-tips of some of these cross-over types taken from the  $F_3$  generation made by Dr. B. L. Sethi\* have shown them to be of diploid chromosome constitution.

The occurrence of crossing-over in the progeny of

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this tetraploid-diploid cross is regarded as being highly important from the point of view of its bearing upon the chromosome constitution of fatuoids in hexaploid oats, and consequently upon theories relating to the origin of fatuoids in oats.

On the theory of the origin of fatuoids by 'chromosome aberration' as advanced by Huskins,<sup>1</sup> the chromosome constitution of the di-triploid group concerned with the fatuoid phenomenon is represented by the formulæ  $\frac{ABC}{ABC}$ ,  $\frac{ABC}{ABB}$ , and  $\frac{ABB}{ABB}$  for homozygous normal, heterozygous fatuoid, and homozygous fatuoid respectively (where *B* represents the chromosome bearing the fatuoid or *fatua* factors and *C* the chromosome bearing the factor or factors for normal or cultivated type of grain). On analogy with the *A. barbata-A. brevis* cross, if a chromosome bearing *fatua* or fatuoid factors pairs with a chromosome bearing a factor or factors for normal or cultivated grain, that is, if *B* pairs with *C*, as in the heterozygous fatuoid formula above, crossing-over should occur. Much fatuoid segregating material has been studied by different investigators, but so far no cross-over types have been recorded.

On the other hand, on the basis of the theory of the origin of fatuoids by mutation, as put forward by Jones,<sup>2</sup> and supported by Nishiyama,<sup>3</sup> in which the di-triploid group is represented by the formulæ  $\frac{ABC}{ABC}$ ,  $\frac{ABC}{ABC_1}$ , and  $\frac{ABC_1}{ABC_1}$  for homozygous normal, heterozygous fatuoid, and homozygous fatuoid respectively ( $C_1$  representing a mutational change in the *C* chromosome), no cross-over types are theoretically expected, and, as already stated, none so far have been found.

It appears to me, therefore, that the occurrence of crossing-over in the tetraploid-diploid cross (*Avena barbata-A. brevis*) gives further support to the hypothesis that fatuoids in hexaploid oats arise by mutation rather than by chromosome aberration.

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<sup>1</sup> Huskins, C. L., *J. Genetics*, 18; 1927.

<sup>2</sup> Jones, E. T., *J. Genetics*, 23; 1930.

<sup>3</sup> Nishiyama, I., *Japanese J. Genetics*, 7; 1931.

#### Molecular Dissociation by Electron Impact

ABOUT two years ago I noticed<sup>1</sup> that the positive ions generated along the path of an electron beam nearly all came out of the electron beam at right angles to it with energies of the order of 1 or 2 volts, that is, considerably higher than their thermal energies. I found that this was due to a radial potential gradient being set up around the electron beam by concentration gradients in the electron gas surrounding the beam. The presence of these radial potential gradients would introduce considerable difficulties into the accurate measurement of the kinetic energies of the dissociation products formed by electron impact in a molecular gas, for the dissociation products possess energies of only the same order of magnitude as the energy gained in falling through the potential gradient set up by the electron beam.

In a recent investigation by Tate and Lozier<sup>2</sup> of the energies of the dissociation products of nitrogen and carbon monoxide formed by electron impact, no account has been taken of the possible existence of these radial potential gradients. It is not possible to determine from my work the value of the potential gradient in Tate and Lozier's investigation, for they worked at lower pressures, and the effect of pressure on the value of the potential gradient has not been