

SEX-LINKED MUTANT CHARACTERS IN THE HEMP, *CANNABIS SATIVA*

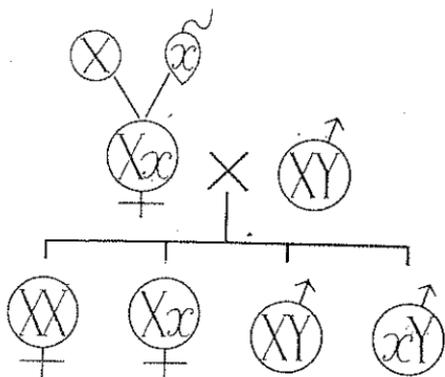
By YOSHITAKA IMAI

Tokyo

(With One Diagram)

From the literature few cases of sex-linked inheritance are known to have occurred in the higher plants. Baur's *angustifolia* form of *Melandrium album* (1912) was the first to be discovered in this field, the form being manifested by a recessive gene located in the X-chromosome. The genetics of the character were studied in detail by Shull (1914). Later, Winge (1920) found a second case in the hybrid progeny of *Melandrium album* and *M. rubrum*. The *chlorina* form was transmitted to the male, but no female plants showed any yellowish foliage, from which Winge concluded the gene to be located in the Y-chromosome with a dominant effect on the normal allele. To account for the complicated segregation of the *chlorina* character in the hybrid progeny he further postulated two autosomal recessive genes, the character being manifested under their co-operation. In this paper, I intend to present two new additional cases of sex-linked inheritance in the hemp, *Cannabis sativa*, the mutant characters being induced by the action of X-rays.

Pollen of the hemp was X-rayed for 30 min., the current being 5 mA. under 50 kV. at a distance of 25 cm. The pollen was then applied to the stigma of pistillate flowers. The seeds obtained were sown and the plants were allowed to fertilize among themselves. This year (1937) I raised their offspring. If any gene mutation had occurred as the effect of the X-rays in the X-chromosomes that were contained in the applied pollen, then half the number of male plants in the pedigrees raised this year should exhibit a mutant character.



The scheme for observing the appearance of mutant characters is shown in the accompanying diagram. The X-chromosomes that contain a mutant gene are designated by a small letter, i.e. x .

Only twenty-three pedigrees derived as the result of fertilization by X-rayed pollen were examined, two of which included mutant males. In one pedigree, yellowish green, or *chlorina*, seedlings appeared, all of which grew to be males; while, in the other, yellow-mottled plants invariably bore staminate flowers. As the result of less photosynthesis, the *chlorina* plants are less vigorous than the normal green. The yellow mottling in the other mutation, which later becomes green, is evident only in young leaves. Owing to the summer drought, some of the seedlings died before bearing inflorescence, so that the data for the two seasons are shown separately in Table I. For control, 449 pedigrees were tested, but no mutant characters were found.

TABLE I

		Normal		Mutant		Total
		Female	Male	Female	Male	
Yellow pedigree	Seedling	24		8		32
	Plant	7	4	0	6	17
Mottled pedigree	Seedling	48		11		59
	Plant	25	20	0	7	52

The two mutant characters, therefore, are believed to be located in the X-chromosomes. Owing to their recessive nature, they appeared only in the males when the genes were contained in a hemizygous condition. The sex of the hemp is determined by the XY-mechanism as worked out by Hirata (1927). According to his observation, the male is heterogametic, containing, besides eighteen autosomes, a large X and a small Y. From the genetic data presented above, the Y-chromosome is regarded as inert, or at least partly so. Next year I expect to have some females with mutant characters by the coming together of two X-chromosomes with mutant genes.

REFERENCES

- BAUR, E. (1912). "Ein Fall von geschlechtsbegrenzter Vererbung bei *Melandrium album* (Kleinere Mitteilung)." *Z. indukt. Abstamm.- u. VererbLehre*, **8**, 335-6.
- HIRATA, K. (1927). "Sex determination in hemp (*Cannabis sativa*, L)." *J. Genet.* **19**, 65-79.
- SHULL, G. H. (1914). "Sex-limited inheritance in *Lychnis dioica* L." *Z. indukt. Abstamm.- u. VererbLehre*, **12**, 265-302.
- WINGE, Ö. (1920). "On a Y-linked gene in *Melandrium*." *Hereditas, Lund*, **9**, 274-84.