must be taken into account when the crystalline layer has a structure such as we find in the clay minerals.

When the sphere of radius $|OP|$ cuts the diffused line far from the b_1b_2 plane, we can write approximately

$$\int FF^*SS^*dA = FF^* \int SS^*\,dA'/\sin\alpha.$$

Here dA' is the projection of dA on to a plane through P parallel to the b_1b_2 plane, and α is the angle POC. If we put ON (see diagram) equal to $2\sin\theta_0/\lambda$, then $\sin\alpha = (\sin^2\theta - \sin^2\theta_0)^{1/2}/\sin\theta$, and since quite generally $\int SS^*dA' = NA_a$, where N is number of cells per crystal, we obtain at once

$$\frac{dE}{d(2\theta)} \doteqdot \frac{I_0 e^4 \lambda^2}{m^2c^4RA_a}\left(\frac{1+\cos^2 2\theta}{32\,\pi\sin\theta}\right)\frac{FF^*}{(\sin^2\theta - \sin^2\theta_0)^{1/2}}$$

valid for $\theta \gg \theta_0$, which is exactly the expression given by Warren.

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Dec. 18.

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INHERITANCE OF SEX FORMS IN *LUFFA ACUTANGULA* ROXB.

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SEX habit in plants is known to be controlled by genetic factors, although subject to environmental fluctuations. Poole and Grimball[1], working on the inheritance of certain new sex forms in *Cucumis melo*, a member of the Cucurbitaceæ, have reported that the hermaphrodite form is genetically a double recessive to monœcious, and in F_2 populations from crosses between them the following phenotypic ratio was obtained—9 monœcious : 3 andromonœcious : 3 gynomonœcious : 1 hermaphrodite. The gynomonœcious type was, however, susceptible to environmental fluctuation, giving rise occasionally to gynœcious and trimonœcious forms. On the basis of these results they have designated the several sex forms in their material as follows: monœcious (AG), andromonœcious (aG), gynomonœcious (Ag) and hermaphrodite (ag).

Inheritance studies of sex forms in *Luffa acutangula*, another member of the Cucurbitaceæ, have been in progress at the Indian Agricultural Research Institute, New Delhi, for the last four years, and a preliminary account of the results obtained is presented in this note.

L. acutangula is ordinarily a monœcious species, although a hermaphrodite form, locally named salputya, is known to be cultivated as a vegetable in Bihar. In the year 1943, in the garden of one of the residents of the Institute, a crop of this species was found to contain a few hermaphrodite and andromonœcious plants besides a majority of monœcious plants. In the monœcious plants the male flowers are in a raceme while the female flowers are borne singly in the axils of leaves. The flowers in the hermaphrodite forms are borne in clusters of 10–20, about 50 per cent of which set fruits. In the andromonœcious type, the perfect flowers are borne singly like the female flowers of the monœcious plant. The three types, on self-pollination, were found to be true breeding. Figs. 1–4 illustrate inflorescences of the three sex forms and of a gynœcious type which appeared in one of the crosses.

Crosses were made between the three sex forms in all combinations, and the results are given below. The symbols used to designate the various types are explained later in the note.

(1) *Monœcious* ($AAGG$) × *Hermaphrodite* (a^1a^1gg). F_1 plants (Aa^1Gg) were monœcious. The F_2 segregation of sex types, which indicated the interaction of two pairs of factors, was as follows :

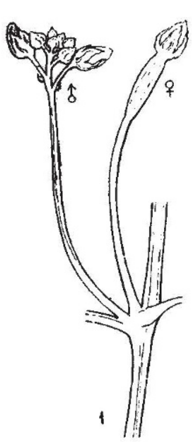

Fig. 1. Monœcious

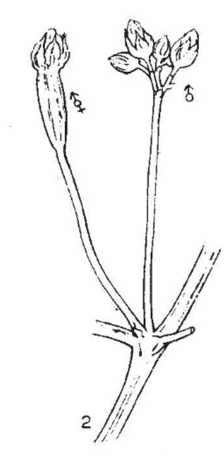

Fig. 2. Andromonœcious

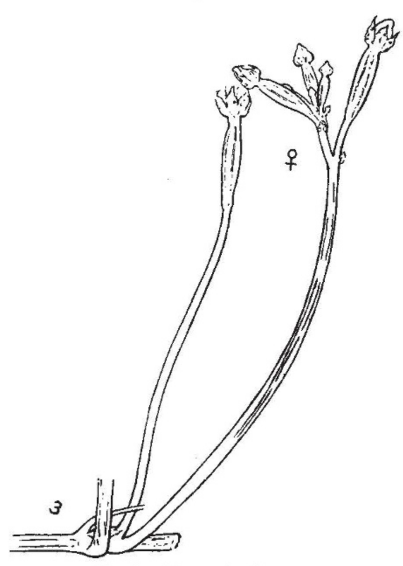

Fig. 3. Gynœcious

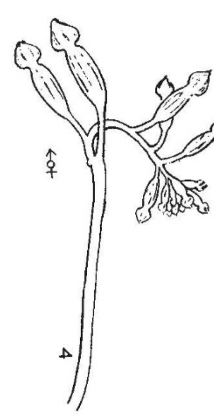

Fig. 4. Hermaphrodite

	Observed	Expected (9:3:3:1)	
Monœcious (AG)	142	129·6	P between
Andromonœcious (a^1G)	36	43·2	0·3 and 0·2.
Gynœcious (Ag)	42	43·2	The fit is
Hermaphrodite (a^1g)	10	14·4	good.

A number of F_3 populations raised from selected F_2 plants representing the different classes supported the hypothesis of two-factor inheritance.

(2) *Monœcious* ($AAGG$) × *Andromonœcious* (a^1a^1GG). F_1 plants (Aa^1GG) were monœcious. In the F_2, monœcious and andromonœcious types segregated in the ratio of 3 : 1 as under:

	Observed	Expected (3:1)
Monœcious (AG)	23·0	22·5
Andromonœcious (a^1G)	7·0	7·5

(3) *Hermaphrodite* (a^1a^1gg) × *Andromonœcious* (a^1a^1GG). F_1 plants (a^1a^1Gg) were andromonœcious. In the F_2, andromonœcious and hermaphrodite segregated in the ratio of 3 : 1 as stated below:

	Observed	Expected
Andromonœcious (a^1G)	17	18
Hermaphrodite (a^1g)	7	6

The two-factor inheritance obtained in the above crosses was further confirmed by the following test crosses:

(1) Monœcious ($AAGG$) × Hermaphrodite (a^1a^1gg) × Monœcious ($AAGG$). The progeny ($AAGG$, $AAGg$, Aa^1GG, Aa^1Gg) was all monœcious.

(2) Monœcious ($AAGG$) × Hermaphrodite (a^1a^1gg) × Hermaphrodite (a^1a^1gg). The progeny segregated in the ratio of 1 monœcious (Aa^1Gg) : 1 andromonœcious (a^1a^1Gg) : 1 gynœcious (Aa^1gg) : 1 hermaphrodite (a^1a^1gg).

(3) (i) Gynœcious ($AAgg$) × Monœcious ($AAGG$). The progeny was all monœcious. (ii) Gynœcious (Aa^1gg) × Monœcious ($AAGG$). The progeny was all monœcious.

(4) (i) Gynœcious ($AAgg$) × Andromonœcious (a^1a^1GG). The progeny was all monœcious. (ii) Gynœcious (Aa^1gg) × Andromonœcious (a^1a^1GG). The progeny consisted of monœcious and andromonœcious in the ratio of 1 : 1.

(5) (i) Gynœcious ($AAgg$) × Hermaphrodite (a^1a^1gg). The progeny consisted of all gynœcious plants. (ii) Gynœcious (Aa^1gg) × Hermaphrodite (a^1a^1gg). The progeny consisted of equal proportions of gynœcious and hermaphrodite plants.

It is clear from the foregoing results that two pairs of factors are involved in the inheritance of sex forms in the various crosses. There is, however, an interesting difference between the phenotypic segregation observed by Poole and Grimball and that obtained by us in the F_2 population of the cross between monœcious and hermaphrodite. While the former obtained 9 monœcious : 3 andromonœcious : 3 gynomonœcious : 1 hermaphrodite in the F_2, our population showed 9 monœcious : 3 andromonœcious : 3 gynœcious : 1 hermaphrodite; the gynomonœcious form in their material was replaced by gynœcious in our F_2 population. Furthermore, unlike the gynomonœcious type of Poole and Grimball, the gynœcious type was stable and did not show any environmental variations. It would appear, therefore, that the gynœcious form is a definite genotype different from that of the gynomonœcious.

On the basis of these results it seems reasonable to suppose that two gene loci each with a multiple allelomorphic series (A-a^1-a and G-g^1-g) are concerned in the inheritance of the sex forms in *Luffa*. Thus, the various possible sex forms may be tentatively designated as: Monœcious AG, Andromonœcious a^1G, Andrœcious aG, Gynomonœcious Ag^1, Gynœcious Ag, Hermaphrodite ag, a^1g^1, a^1g and ag^1.

The above tentative genic hypothesis is in accord with the results obtained in the various crosses studied by us. It also provides an explanation for the different phenotypic segregations in the F_2 of the cross between monœcious and hermaphrodite, observed in our material and that of Poole and Grimball. It is likely that the genotype of the hermaphrodite form used in crosses with monœcious by Poole and Grimball was of the constitution $a^1a^1g^1g^1$, in which case the F_2 segregation would give 9 monœcious (AG), 3 andromonœcious (a^1G), 3 gynomonœcious (Ag^1) and 1 hermaphrodite (a^1g^1).

We have not so far come across andrœcious and gynomonœcious forms nor a diœcious species of *Luffa*; but it is possible that they may be found in the future when further investigations will be undertaken to confirm or modify the hypothesis proposed in this note.

We are indebted to Dr. N. Parthasarathy, geneticist, Indian Agricultural Research Institute, for reading through the manuscript and making some useful suggestions.

[1] Poole, O. F., and Grimball, P. C., *J. Hered.*, **30**, 21 (1939).

PLANT VIRUS RESEARCH AT CAMBRIDGE

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On April 29, at an informal gathering in Cambridge, the new field laboratory of the Plant Virus Research Unit of the Agricultural Research Council was inaugurated, and demonstrations illustrating the principal researches carried out there were staged.

The ceremony also marked the twenty-first anniversary of the establishment at Cambridge of the Plant Virus Research Station, which has now become a research unit of the Agricultural Research Council. The project was started in 1927 under the auspices of the Ministry of Agriculture, and Dr. R. N. Salaman was appointed its first director with the present writer as senior research assistant. The scheme had a two-fold object: (1) to build up nucleus stocks of virus-free potatoes by propagating them in insect-proof glasshouses, and (2) to undertake research, in the first instance, into the virus diseases of the potato plant and their means of spread in the field. As time went on, however, the maintenance of the nucleus stocks of virus-free potatoes became a routine measure and the work was expanded to cover many aspects of plant virus research. Now, with the establishment of the research unit, the virus-free stocks are being handed into the care of the National Institute of Agricultural Botany, which will continue their propagation under glass while maintaining large stocks in strict isolation in the open.

As the importance of virus diseases of plants gradually became recognized, so the work developed, and increasing interest in the activities of the station was taken by workers abroad. Since, with the