On the Coupling of Two Leaf-Characters in the Japanese Morning Glory.[1]

By

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While studying hereditary behavior in the Japanese Morning Glory, I have met with a case of coupling which takes place between two leaf characters. Although the study is not yet completed I shall publish the results so far obtained as a preliminary report.

In 1917 crosses were made between three homozygous races, the one, designated as (5) in the tables given below, having variegated and rolled leaves,[2] while the leaves of the other two, designated as (9A) and (AX), being homogeneously colored and smooth and flat. The F_1 plants thus raised were found to have all homogeneous and normal leaves, showing that the variegated and rolled conditions are both recessive characters.

The variegation in the Morning Glory has already been studied by TAKEZAKI.[3] According to him, the variegation behaves as a simple Mendelian recessive to the normal. Similar results were obtained in my experiments; the segregating numbers observed in the F_2 generation being:—

	Observed			Expected			
	Homogeneously-colored	Variegated	Total	Homogeneously-colored	Variegated.	D.	S.E.
5×9A —a	12	4	16	12.00	4.00	±0.00	±1.73
„ —b	187	67	254	190.50	63.50	±3.50	±6.91
„ —c	10	4	14	10.50	3.50	±0.50	±1.61
„ —d	34	10	44	33.00	11.00	±1.00	±2.87
5×AX—a	23	8	31	23.25	7.75	±0.25	±2.41
„ —b	12	3	15	11.25	3.75	±0.75	±1.67
Totals	278	96	374	280.50	93.50	±2.50	±8.37

1. The substance of this paper was published in "Journal of the Scientific Agricultural Society" No. 206, Oct. 1916 (in Japanese).

2. The margin of the leaves more or less roll upwards, and the surface is usually rather uneven especially in the young lower leaves.

3. Nippon Ikusyugakukai Kaihô (Journal of the Japanese Breeders' Association). Vol. 1, No. 1, 1916.

The results almost agree with the theoretical numbers calculated from the ratio of monohybrid.

The rolled leaves also reappear in the F_2 generation, as is shown in the following table :—

	Observed			Expected			
	Flat	Rolled	Total	Flat	Rolled	D.	S.E.
5×9A —a	13	3	16	12.00	4.00	±1.00	±1.73
„ —b	187	67	254	190.50	63.50	±3.50	±6.91
„ —c	9	5	14	10.50	3.50	±1.50	±1.61
„ —d	30	14	44	33.00	11.00	±3.00	±2.87
5×AX—a	26	5	31	23.25	7.75	±2.75	±2.41
„ —b	12	3	15	11.25	3.75	±0.75	±1.67
Totals	277	97	374	280.50	93.50	±3.50	±8.37

Thus the rolled leaf acts as a recessive to the normal condition and segregates following the simple Mendelian ratio.

Considering these two characters together the four different kinds of plants are expected to be produced in F_2 according to a 9:3:3:1 ratio, if the combination of the factors responsible for these characters follows the ordinary dihybrid scheme. The results obtained, however, were different from the expectation as will be seen in the following :—

	Observed				Expected			
	Homogeneously-colored		Variegated		Homogeneously-colored		Variegated	
	Flat	Rolled	Flat	Rolled	Flat	Rolled	Flat	Rolled
5×9A —a	12	0	1	3	11.06	0.93	0.93	3.06
„ —b	168	19	18	49	175.51	14.73	14.73	48.51
„ —c	9	1	2	2	9.67	0.81	0.81	2.67
„ —d	29	5	2	8	30.40	2.55	2.55	8.40
5×AX—a	23	0	3	5	21.42	1.80	1.80	5.92
„ —b	11	1	1	2	10.37	0.87	0.87	2.87
Totals	252	26	27	69	258.43	21.69	21.69	70.43

The data given above may be explained by assuming the presence of a coupling between these two characters. If we assume the frequent distribution of gametes as 7:1:1:7 according to BATESON and PUNNETT'S scheme, the expected numbers thus calculated cover pretty well the results as have been represented in the above table.

P.S. After this paper has been written a similar case was reported by Y. IMAI in Japanese ("Genetic studies in Morning Glories. I." Botanical Magazine. Nos. 394 and 395, Vol. XXXIII. 1919.)