NOTES AND COMMENTS

CORRELATIONS BETWEEN CHAETA NUMBER AND FLY SIZE IN *DROSOPHILA MELANOGASTER*

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Sternopleural chaeta number in *Drosophila melanogaster* has been used in several extensive experiments designed to explore the effects of natural and artificial selection, and to throw light on the genetic constitution of natural populations. It is, therefore, relevant to ascertain the developmental and physiological factors influencing sternopleural chaeta number, and to find out the function of the chaetæ and how this may vary with number.

The function of these chaetæ is little understood and must await further experimentation. However, factors influencing chaeta number are more easily suggested. Three that seem likely to be of importance locally in the area in which chaeta producing initial cells differentiate are (1) the strengths of the inhibition fields around a chaeta initial (Stern, 1954), (2) the reactivity of cells to the inhibiting factors, and (3) the area of the sternopleural region. Naturally, any of these could be influenced by other factors, and the whole situation must be exceedingly complex.

The easiest of these factors to assess is the size of the fly, as measured by weight, and its effect on the area of the sternopleural region, The latter will be a function of cell size and number, and consequently is likely to depend on factors influencing fly size. Temperature and degree of crowding are known to affect fly size. At high temperatures and high crowding fewer chaetae are present than at low temperatures and low crowding (Mann, 1923 ; Plunkett, 1926). Recent data of Beardmore (see Thoday (1958) and Beardmore (1960)) also demonstrate a fall in chaeta number with increasing temperature.

Experimental results we have obtained, largely independently of each other, have converged to demonstrate a rather general correlation between chaeta number and fly size. For example, it has been shown that as temperature is increased, flies become smaller and have fewer chaetae (table 1). Similarly, under high levels of competition, flies are smaller and have fewer chaetae, and the same effect (fig. 1) occurred when phenyl-thio-carbamide (P.T.C.) was added to the medium. P.T.C. was shown by Parsons and Kroman (1961) to reduce fly size, but to have no other obvious morphological effect.

Now, it seemed reasonable, on the basis of these observations to suspect that selection for increased or decreased chaeta number might produce correlated responses of fly size. This suspicion was confirmed (table 2) using a chaeta number reducing second chromosome produced by Gibson and Thoday (1959) and Thoday and Boam (1959) in a chaeta number selection experiment. Table 3 shows that in flies produced by selection for high chaeta number by Thoday and Boam (1961), there is a correlation between chaeta number, sternopleural plate area and coxa length.
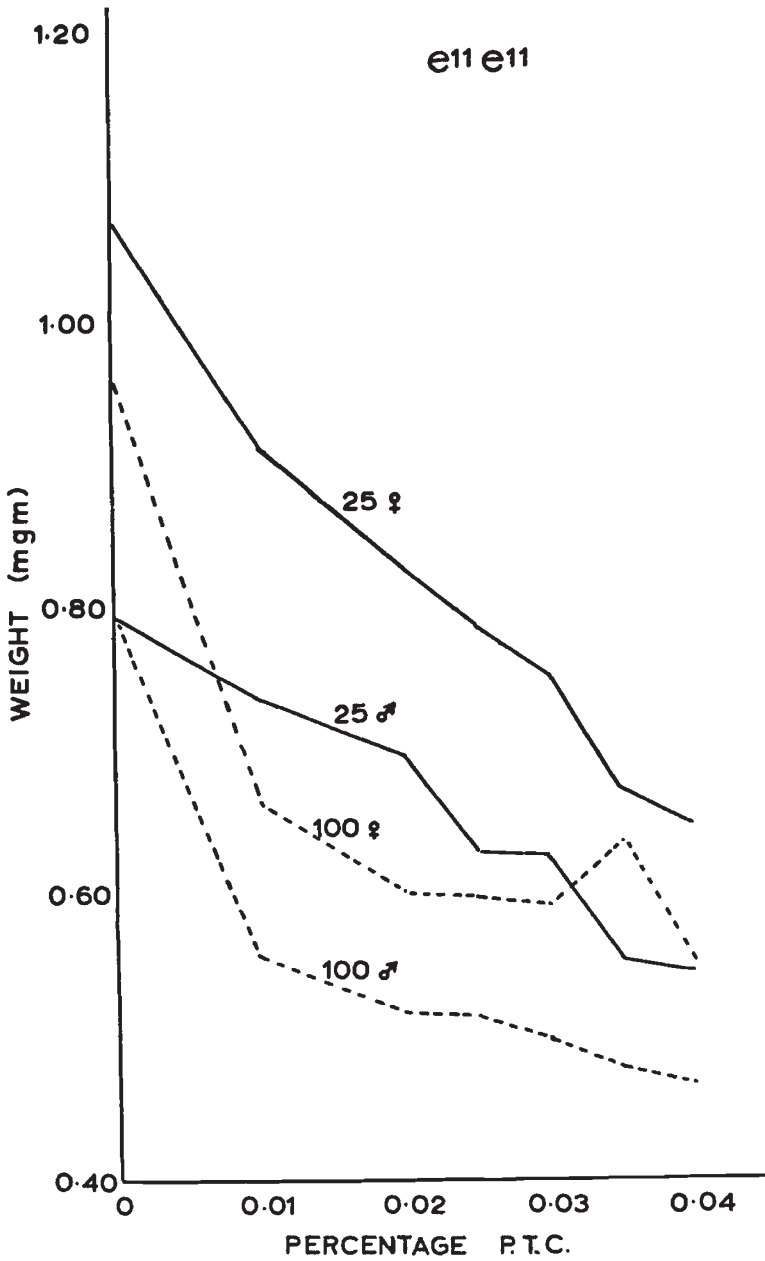
FIG. 1*a*.—Mean fly weight of ebony ($e^{11}e^{11}$) flies at different concentrations of P.T.C. at two levels of competition, namely 25 and 100 larvae per replicate.

Weissman's ring glands have been grafted from high chaeta number genotypes to low, and this led to an increase of both weight and chaeta number. This experiment needs to be elaborated and extended before much significance can be attached to the result ; but it shows that some chaeta number genes act by influencing the hormone balance of
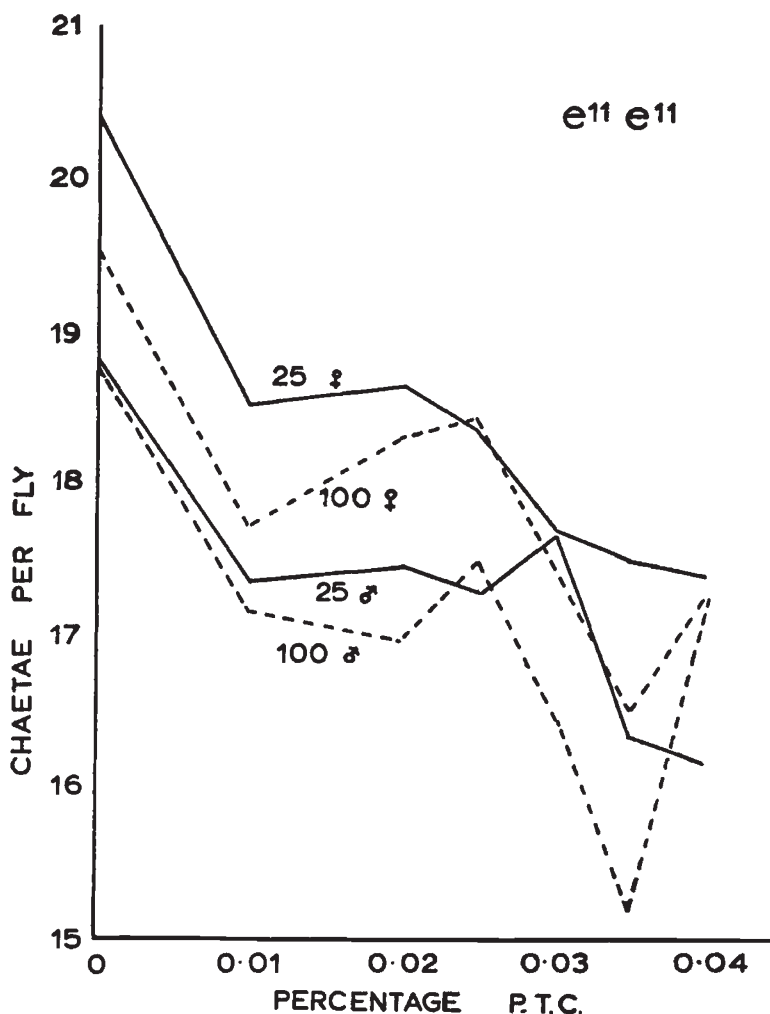

FIG. 1b.—Mean chaeta number of ebony ($e^{11}e^{11}$) flies at different concentrations of P.T.C. at two levels of competition, namely 25 and 100 larvae per replicate.

the fly. It is also supposed that P.T.C. may influence fly size by some complex interaction with hormone production (Parsons, 1961).

We conclude, therefore, that fly size and chaeta number are generally correlated. In a selection experiment the correlation may break down somewhat, since chaeta number is being directly selected, whereas fly size is only being indirectly selected through selection for chaeta number.

Chaeta number has been suggested to be a trivial character by Reeve (1960). This seems unlikely on general grounds, since chaeta production

TABLE 1

A comparison of homozygous y bw st *flies at different temperatures*

	Emergence time (days)		Mean chaeta number per fly		Body weight (mgm.)	
	♀	♂	♀	♂	♀	♂
20° C.	14·83	14·25	19·28	18·55	1·017	0·863
25° C.	8·64	8·47	18·52	17·68	0·953	0·801
28° C.	6·25	6·12	17·83	17·55	0·756	0·523

Each entry in the table represents the mean value of 200 flies.

TABLE 2

A comparison of a low chaeta number and a standard chromosome at
25° C. and 28° C.

	$\frac{bw\ st}{bw\ st}$				$\frac{L^*\ st}{bw\ st}$				Effect of L* on chaetae per fly relative to bw/bw
	Mean chaeta no. per fly		Body weight (mgm.)		Mean chaeta no. per fly		Body weight (mgm.)		
	♀	♂	♀	♂	♀	♂	♀	♂	
28° C.	17·76	17·40	0·728	0·653	15·88	15·73	0·620	0·495	−1·78
25° C.	18·54	17·84	0·964	0·808	16·12	15·51	0·854	0·673	−2·37

Each entry in the table represents the mean value of 100 flies.
* L = Low chaeta number second chromosome.

TABLE 3

Correlation between sternopleural chaeta number, sternopleural plate area, length of the coxa of
the second leg, and the asymmetry of these variables

Line	Sternopleural chaeta number		Sternopleural plate area ($mm^2 \times 10^5$)		Length of coxa of 2nd leg (mm.)	
	Mean	Mean asymmetry *	Mean	Mean correlated † asymmetry	Mean	Mean † correlated asymmetry
Selected Line 1 .	22·52	2·00	154·00	8·32	0·145	0·021
Selected Line 2 .	32·89	3·70	188·80	9·95	0·160	0·013
Selected Line 3 .	37·21	2·42	205·44	7·71	0·163	0·011

* Asymmetry measured by taking the mean of the sides with the highest chaeta number and subtracting that of the sides with the lowest chaeta number.
† Asymmetry measured by taking the mean of the areas of the sides with the highest chaeta number and subtracting that of the sides with the lowest chaeta number.
Each entry in the table is based on the mean values for 20 female flies.

must involve metabolic effort, and some chaetæ are sensory organs which indicates that their pattern and number must be of some significance. In wild flies, patterns and number are rather constant, though they can be altered by artificial selection, which implies stabilising selection under natural selection. Beardmore (1960) has shown that natural selection influences chaeta number and asymmetry, thus showing the relevance of the character to fitness.

Furthermore, we have evidence that correlated with chaeta number asymmetry, is asymmetry of sternopleural plate area and perhaps the length of the coxa of the second leg (table 3). Hence asymmetry of chaeta number can
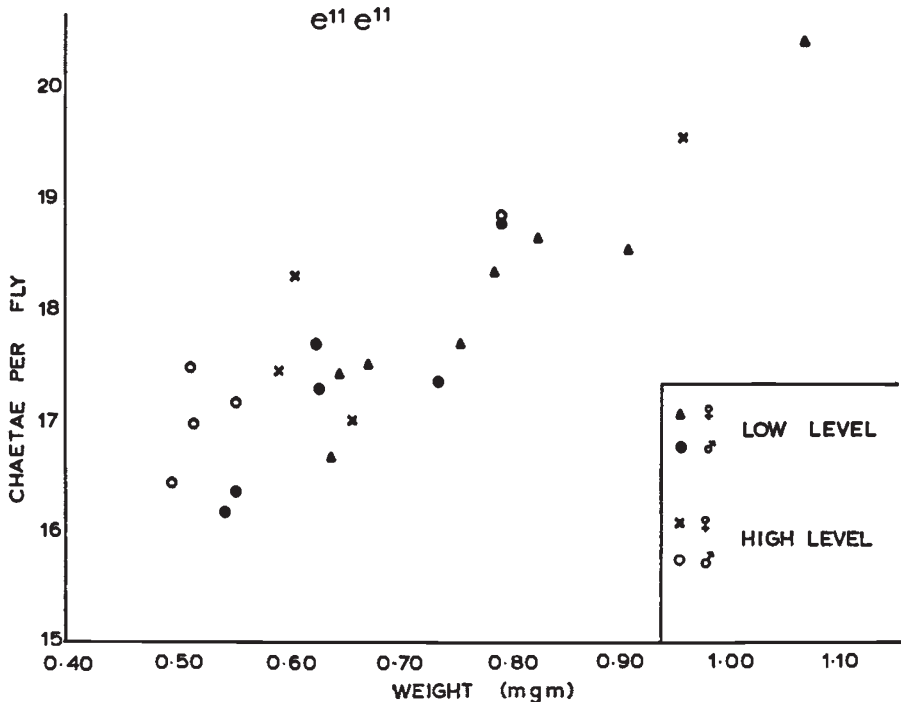

FIG. 1c.—The relation between fly weight and chaeta number for ebony ($e^{11}e^{11}$) flies. The low level represents 25 larvae per replicate, and the high level 100 larvae per replicate.

be regarded as a measure of developmental stability, relevant to more than number itself, which is perhaps why it is a character of some adaptive significance. It should be pointed out here that a measure is useful for assessing adaptive significance, whether adaptive significance arises from the character measured, or from some partly or wholly correlated character.

In conclusion, it must be stressed that chaeta number is a complex character, subject to natural selection, and that many variables independent of fly size are likely to affect chaeta number. Some of these variables are being investigated at present. Until much more is known about this character, the relative importance of the correlation with size and of other aspects of chaeta number associated with fitness will be impossible to assess.

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SEGREGATION IN TETRAPLOID BLACKBERRIES

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1. INTRODUCTION

Modern blackberry breeding is largely confined to improvements at the tetraploid level, and is particularly concerned with the production of early thornless types.   The thornless character is controlled by a recessive gene which was originally given the symbol A/a by Crane and Darlington (1932) ; but following the usage by Lewis (1939) of S/s (= spineless) for the character in *Rubus idaeus* this latter symbol has now been generally adopted.

This character is particularly convenient for a study of tetraploid segregation in F_2 progeny, since differences between the alleles S and s can be readily distinguished during the cotyledon stage of recently emerged seedlings.   At this stage, the S plants have glands along the edges of the cotyledons, whereas the homozygous recessive s plants possess naked cotyledons.   The amount of mis-classification is very low, being confined largely to seedlings with abnormal cotyledons and to very late germinators. Large populations can, therefore, be raised and classified.

Darlington and Crane (1932) examined the F_2 progeny from a cross