Heiskanen, A., P.Jokela, M.Laitinen, M-L. Savontaus and P.Portin. University of Turku, Finland. Effect of temperature on the intraindividual variation of sternopleural bristles in D.melanogaster.

The within-individual or intraindividual component of variation is entirely of environmental origin. It can be measured by multiple measurements within individual, and is therefore called repeatability (Falconer 1981). The within-individual variation is due to special environment in contrast to common environment which together with genetic variation causes variance between individuals. Repeatability can be studied by measurements following each other in time or by measurements of variation between symmetrical or metamerically repeated organs such as sternopleural bristles and abdominal sternite bristles respectively. The within-individual source of variation has also been called developmental noise by Suzuki et al. (1981) since it is principally of stochastic origin the genotype and the common environment being identical for example for bilaterally symmetric organs of the individual. As the cause of the developmental noise Suzuki et al. (1981) suggested the random distribution of rare biologically active molecules such as vitamins the mean concentration of which can be less than one molecule per cell. Such molecules can cause differences between symmetric organs because their distribution is determined largely by chance. Already Astauroff (1930) is studying variation in bilaterally symmetric organs concluded that the differences between the sides of the animal are not due to the environment of the animal but result from a specific quality of the developmental process of the character itself.

Reeve and Robertson (1954) studied the sources of variation in the numbers of sternite chaeta of D.melanogaster, and found out that the special environment caused as much as 58% of the variation, while additive genetic variation was 33%, non-additive genetic variation 6%, and the variation caused by the general environment only 3%. Thus the great majority of the environmental component of the variation was due to special environment (developmental noise).

We investigated the variation of sternopleural bristles of D.melanogaster in the crossbred Canton-S stock, and in the inbred Samarkand stock (256 generations of sib mating) in different temperatures (20°C and 29°C). We counted the numbers of sternopleural bristles on both sides of the flies separately in 75 females and males raised in 20°C and 29°C. The variances are given in Table 1. Since the genetic variance is nonexistent in the inbred stock, we could divide the variance in the crossbred stock into components as follows. The within-individual variation gives the effect of the special environment, and the rest of the variance was divided into genotypic and common environmental variance. The environmental variance was obtained by substracting the between individuals variance of the inbred stock from the between individuals variance of the crossbred stock. The components of the variance are given in Table 2 for the crossbred stock in both temperatures. It can be seen that the variance caused by the special environment is significantly greater in 20°C ($F=2.08^{**}$). Thus the developmental noise is higher in higher temperature. It is suggested that this is caused by increased movement of small biologically active molecules in the higher temperature.

Table 1. The variances in numbers of sternopleural bristles in an inbred (Samarkand) and crossbred (Canton-S) stock in different temperatures. The number of females and males examined in each series was 75.

| | 20° C | | | 29° C | | |
|---|---|---|---|---|---|---|
| | ♀ | ♂ | mean | ♀ | ♂ | mean |
| SAMARKAND (inbred) | | | | | | |
| Within individuals | 0.76 | 0.85 | 0.80 | 1.47 | 1.44 | 1.45 |
| Between individuals | 2.02 | 1.87 | 1.95 | 2.84 | 2.38 | 2.61 |
| Total variance | 2.78 | 2.71 | 2.75 | 4.30 | 3.82 | 4.06 |
| CANTON-S (crossbred) | | | | | | |
| Within individuals | 1.01 | 1.11 | 1.06 | 2.55 | 1.86 | 2.21 |
| Between individuals | 3.72 | 4.64 | 4.18 | 6.78 | 5.01 | 5.90 |
| Total variance | 4.73 | 5.76 | 5.24 | 9.33 | 6.88 | 8.10 |

Table 2. The sources of variance in the crossbred Canton-S population in different temperatures. N = 150 in each series.

| | Proportion of variance (%) | |
|---|---|---|
| Source of variance | 20°C | 29°C |
| Genotypic | 42.5 | 40.6 |
| Common environment | 37.1 | 32.2 |
| Special environment | 20.3 | 27.2 |
| Total | 100.0 | 100.0 |

References: Astauroff, B.O. 1930, Z.Indukt.Abstamm.u.Vererbungsl. 55:183-262; Falconer, D.S. 1981, "Introduction to Quantitative Genetics" Longman Group Ltd.; Reeve, E.C.R. & F.W. Robertson 1954, Z.Indukt.Abstamm.u.Vererbungsl. 86:269-288; Suzuki, D.T., A.J.F.Griffiths & R.C.Lewontin 1981, "An Introduction to Genetic Analysis" Freeman & Co.

Herforth, R.S.[1], H.L. Carson[2] and L.Chang.[2]
1 Augsburg College, Minneapolis, Minnesota USNA. 2 University of Hawaii at Manoa, Honolulu, Hawaii USNA. A new arrival to the Hawaiian Islands: Drosophila cardini.

In March of 1983 a female Drosophila was collected in Honolulu near Leahi Hospital. The collection site was at the southeast corner of Kilauea Avenue and Makapuu, near property occupied by Kapiolani Community College. The fly was caught in a banana trap hung from branches of what appeared to be the cactus Cereus undatus. This female died without laying any eggs, but her external characters indicated that she was probably a member of the cardini group. These characters included: clouded crossveins; black bands on the posterior edge of yellowish-brown abdominal tergites, with the black in the lateral areas not reaching the lateral edge of the tergites and extending anteriorly and medially in the posterior tergites; brilliant orange eyes; and reddish-brown mesonotum, scutellum and pleurae. Another female was collected from the same site in August of 1983, again using a banana bait. This female was successful in laying eggs, and an isofemale line was established. Examination of males of this line showed that they lacked a protuberance on the anteroventral margin of the labellum and possessed anal plates with one or two long anteriorly directed bristles on the anteromedial corner of the plates. These features are characteristic of D.cardini Sturtevant (Stalker 1953).

Since the cardini group consists of about 16 sibling and near-sibling species, the metaphase chromosome group was determined by brain smears. This showed the presence of 6 pairs of chromosomes, including 5 pairs of acrocentrics and one pair of microchromosomes. D.cardini is the only member of the species group which has this somatic metaphase figure (Futch 1962; Heed & Russell 1971). The chromosomal and morphological features thus lead to the conclusion that these flies are members of Drosophila cardini Sturtevant. This species has been found in Florida, Mexico, Central and South America, and the West Indies but has never before been recorded from the Hawaiian Islands. In fact no other species of cardini group has been found here. D.cardini thus represents a new arrival to the Hawaiian Islands.

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Ref: Futch,D.G. 1962, Univ.Texas Publ. 6205:539-554; Heed,W.B. & J.S.Russell 1971, Univ.Texas Publ. 7103:91-103; Stalker,H.D. 1953, Ann.Ent.Soc.Amer. 56:343-358.

Holliday, M. and J.Hirsch. University of Illinois, Urbana-Champaign, Illinois. Excitatory (Pavlovian) Conditioning.

Using a variation of Nelson's (1971) procedure for conditioning the blow fly Phormia regina, we demonstrate excitatory conditioning of the proboscis extension reflex in D.melanogaster.

The flies came from a population established by crossing the Berlin line with another produced by mixing nine Austin, TX inbred lines obtained from Birmingham, England. They were virgin males and females, 44-48 hr old, 36 hr food deprived and water satiated, when conditioned on the automated stimulating apparatus (Vargo, Holliday & Hirsch 1983; Holliday, Vargo & Hirsch 1983).

As outlined in Figure 1, the conditioning procedure presents for 5 sec to the foretarsi a 0.5-M NaCl conditioned stimulus (CS), followed after a 0.5-sec interval by a 0.25-M sucrose unconditioned stimulus (US) for 5 sec (also accessible to the proboscis for 2-3 sec), itself followed after a 170-sec interval by a distilled $H_2O$ intertrial stimulus (ITS) for 5 sec, which, in turn, is followed after a 175-sec interval by the start of the next trial. Thus, the intertrial interval (ITI) is 6 min. The ITS serves to discharge any residual sucrose induced excitatory state (CES, Dethier, Solomon & Turner 1965) which in D.melanogaster can last at least 10 min (Vargo & Hirsch 1982a,1982b). With a 6-min ITI, it is important to discharge CES in order to avoid confounding non-associative excitation with associative responding (conditioning) to the CS.

For 111 flies Figure 2 presents average results combined from four experiments. Over nine trials, responding (1) to the CS increases significantly (regression coefficient: B=3.7,