Phylogenetic study of Cephalopharyngeal sclerites and mouth hooks dentition in different species of *Drosophila* larvae

A.Z.K. Muhammad Ali*

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Summary

Drosophila larvae of different species were subjected to this investigation in order to study the structure of cephalopharyngeal armature and mouth hooks dentition in correlation with their food resources (food habitat) which are more likely genetically controlled. A comparative study of third instar larvae was carried out using a large stock of mass bred population cage which established from fourteen isofemale inbred lines of ***Drosophila melanogaster*** Seraleone strain, and eight species of ***Drosophila melanogaster*** species subgroup, since these species were breeding in laboratory for several generations feeding on yeasted oatomeal medium under room conditions at about 25 ± 1 C°, in addition to the five fungal breeding wild type species. The statistical analysis of the results revealed: 1- there was high significant differences in teeth number among the three larval stages of ***D. melanogaster*** species which evolutionary reflects the natural development related with the food acquisition for each larval stage. 2- There was a highly significant heterogeneity of variance between the lines, the interesting here was that the average among the lines variance is substantially greater than the sample variance for the mass bred population. 3- Non-parametric test indicated that the differences between the eight species of ***D. melanogaster*** species subgroup were highly significant, since these species differ in their geographical distribution. 4- The cephalopharyngeal seclerites and the mouth hooks of the five fungal breeding species were more robust and the dentition was larger , so the difference between the five means were significantly high , which may be due to their food resources difference. 5- Inbreeding effects on the stability of mouth tooth number were investigated by comparing the expressing of character in the large cage population and 15 isofemale inbreed strains.

Introduction

Substrates exploited by temperate woodland ***Drosophila*** have been grouped into four principal categories (Shorrocks 1982) these are 1- fermenting fruits, 2- sap fluxes , 3- fungi, 4- decaying plant material such as leaves , stems and roots . The mouth hooks of Drosophila larvae play an important role in feeding activity. They protrude from the mouth and are extended and retracted in scooping movements. The significance of the hooks in the phylogeny and ecology of taxonomic viewpoint by Okada (1963 & 1968). Okada (1963) showed that the morphology of the larval cephalopharyngeal apparatus and the number of teeth on the mouth hooks vary among larvae of difference species. These differences are thought to reflect adaptation of larvae to their food resources. As Shorrocks (1982) points out there is a tendency for the number of the mouth hooks of different species to increase as we pass from sap , to fruit , to fungal feeding habits . If there is a correlation between the morphology of the mouth hook armature and the nature of the habitat

* Biology Department / College of Science / University of Baghdad /Baghdad

and food substrate exploited by larvae, it may be possible to make at least some broad inferences about the larval ecology of species where this information is not already available, or else very imperfectly known, as is case for certain species of the ***melanogaster*** species subgroup. In this study the morphology of the cephalopharyngea sclerites and mouth hooks of ***D.melanogaster*** is briefly described, and a comparative study made of the mouth hooks of five species of European temperate woodland fungal breeding species, and the eight presently known species of the ***melanogaster*** species subgroup. The number of teeth on the mouth hooks of a third instar larva is a quantitative character. In the adult insect, quantitative variation in morphological characters such as the number of abdominal, scutellar and sternopleural bristles or chaetae, has been the subject of numerous studies since the early investigations of Mather (1941), Payne (1918) and Wigan (1941). No attempt will be made here to provide a review of this literature for which Mather (1983) gives a useful starting point. The literature is virtually silent on the subject of comparable variation in meristic characters in larvae of ***Drosophila***, that is, characters of a discrete number of repeated structures such as bristles. This may be because, compared to the adult insect, the larva appears to have little suitable morphology to study. It is already known that the number of teeth on the larval mouth hooks can vary among species. There may be variation between individuals within a species. Alpatov (1929) noted that the number of teeth present in an individual increases at each instar. Since the mouth hooks are paired structures located on the left and right side of a larva, there may also be differences in the number of teeth within individuals or lateral asymmetry. The amount of variation in the morphology of the larval mouth hooks could have implications for their use as a taxonomic character and also as an indicator of adaptation to particular larval habitats. This study examines how much individual variation there is in mouth hook morphology within species, and what effect inbreeding in laboratory strains may have on the stability of expression of tooth number.

Materials and Methods:

Different Drosophila cultures used in this investigation are as follow:

A- ***Drosophila melanogaster*** species subgroup.

1- ***D. erecta.***
2- ***D. mauritiana***
3- ***D. orena.***
4- ***D. sechellia.***
5- ***D. simulans.***
6- ***D. teissieri.***
7- ***D. yakuba.***
8- ***D. melanogaster.***

Cultures of these species were obtained from the National Scientific Research Center, France.

B- Fungal breeding species.

1- ***D. kuntzei.***
2- ***D. phalerata.***
3- **D. subobscura.**
4- **D. transversa.**
5- ***D. testacea.***

Cultures of these species were obtained from the Department of Genetics ,University of Oulu, Finland.

C- ***D. melanogaster*** wild strains

1- Isofemale inbred line is derived from a single wild female captured at Valeta, Malta.
2- Mass bred cage population was established from 15 separate isofemal inbred strains, each was derived from a different wild female captured at a single site in transitional habitat near Freetown Sierra Leone, in (1982). For more details see Gogarty(1985) . These strains

were denoted as: SL1, SL2, SL3, SL4, SL5, SL6, SL7, SL8, SL9, SL10, SL11, SL12, SL 13, SL14 and SL15.

Virgin flies were collected from each separate line and reciprocally intercrossed to give 14 separate F1 progenies as follows:

♀ 12 x 9 ♂	♂ 12 x 9 ♀
♀ 8 x 1 ♂	♂ 8 x 1 ♀
♀ 5 x 2 ♂	♂ 5 x 2 ♀
♀ 14 x 10 ♂	♂ 14 x 10 ♀
♀ 13 x 7 ♂	♂ 13 x 7 ♀
♀ 3 x 4 ♂	♂ 3 x 4 ♀
♀ 6 x 11 ♂	♂ 6 x 11 ♀

Virgin F1 individuals were than intercrossed as follows:

♀ (6 x 11) x (3 x 4) ♂ ♀ (7 x13) x (6x11) ♂
♀ (3x4) x (13x 7) ♂ ♀ (10x14) x(3x 4) ♂
♀ (13x 7) x (14x 10) ♂ ♀ (2 x5) x(13 x 7) ♂
♀ (10 x 14) x (5x 2) ♂ ♀ (8 x1) x(14 x 10) ♂
♀ (5x 2) x (8 x1) ♂ ♀ (9 x 12) x (6 x 5) ♂
♀ (8x 1) x (12 x9) ♂ ♀ (1 x6) x (8 x 1) ♂
♀ (12 x 9) x (6x 11) ♂ ♀ (4 x 3) x(12 x 9) ♂

The F2 progeny of these intercross cultures were allowed to mate randomly and then 20 pairs of flies from each of the 15 cultures (280 pairs in all) were used as the founder generation for the Siera Leone population cage.

D- Flies were cultured in half- pint glass milk bottles containing of freshly yeasted oatmeal medium in a temperature room at about 25 C°. Humidity was constant. Stock cultures were turned over to fresh medium every fourteen days. The population cage was maintained in a glass aquarium tank (36 x 15 x 15 inches) in the same lab. conditions.

E- Specimens preparation: Larval mouth parts were dissected and mounted directly in Berlese fluid (gun chloral) which clears insect tissue showing the pigmented chitinous mouth hooks and cephalopharyngeal sclerites to be observed without staining. The sum of 480 individuals of ***Drosophila*** larvae were used for testing the morphology of cephalopharyngeal sclerites and mouth hook counts, using dissecting microscope with 10 x 10 magnification power.

Results

1- Morphology of the mouth hooks and cephalopharyngeal sclerites of D. melanogaster:

A description of the mouthparts of cyclorrhaphous Dipteran larvae was given by Strasburger (1932) In ***D. melanogaster***, these consist of an anterior pair of mouth hooks which articulate behind with a chitinous H – shaped sclerite, the posterior arms of which in turn articulate with paired vertical lateral forked plates connected dorsally by a chitinous bridge. The chitinous mouth parts of the three larval instars are shown in figure (1). In the first instar, the larva has a single anterior unpaired dorsal element which functions as an egg tooth. This is used by the larva to rupture the vitelline membrane surrounding the egg at the time of eclosion. This egg tooth is not present in subsequent instars. New mouth hooks and associates are formed inside the old ones which are then shed at the next ecdysis. After the moult, the new hooks and sclerites harden .At each moult , a larger structure replaces the former one and the size difference between the mouth hooks of the three instars can be easily seen. The number oh teeth on the left and right side was summed to give a total for each individual the mean number of teeth in each larval instars in the massbred Nairobi wild stock of ***D. melanogaster*** is shown in table -1 . First instars larvae were found to have a mean of 1.75 teeth per individual and this mean number is more than double in each of the two following instars. The variance of tooth number increases with the

mean. Bartletts test confirms that the differences in variance between groups are significant (P<0.001). Consequently the non-parametric Kruska-Wallis test has been used to test for the significance of the differences in mean tooth number between instars. The value of H = 44.1 indicates that the differences among the three means are highly significant (P<0.001). The difference in tooth number in each individual between the left (L) and right(R) sides may be measured using coefficient or index (I).

$$I = \frac{|L - R|}{L + R}$$

The (| |) indicates that the sign of the difference should be ignored. The mean coefficient of asymmetry for larvae of different instars in the Nairobi stock is shown in table (2) since Bartlett's test indicates heterogeneity of variance the non-parametric Kruskal-Wallis test has been used to test for statistical significance of differences in mean asymmetry between instars. The test reveals no significant differences in expression of asymmetry as larval development proceeds. The effect of breeding on the stability of tooth number was investigated by comparing the expression of the character in the large cage population and 15 isofemale in bred strains. Details concerning these stocks are given in materials and methods mention before. Table (3) shows the mean tooth number for third instar larvae of the cage population and inbred lines. The inbred lines vary in mean tooth number from 8.7 (line Sl2) to 19.4 (line SL5). There is significant heterogeneity of variance between the lines. The Kruskal – Wallis test shows that the differences in mean tooth number between the inbred strains are highly significant (p<o.oo1). The mean of the 15 inbred lines means is 13.9 and this compares with mean for the massbred cage population of 14.6 ± 0.66. Interesting here is that the average within line variance (13.6) is substantially greater than the sample variance for the mass bred population (10.8). Asymmetry in the number of teeth is often associated with morphological abnormalities in the mouth hooks themselves. Some examples from the cage population are shown in figure (2). Figure (3) illustrates cases from the inbred lines. These suggest that control of tooth number may be connected with regulation of development of the mouth hooks as a whole. Table (4) shows that the coefficient of asymmetry varies widely between inbred lines from 0.067 (line 11) to 0.456 (line 6). The mean of the 15 inbred lines means, 0,174 compares with 0.156 ± 0.025 for the cage population.

2- Mouth hooks of larvae of the *melanogaster* species subgroup:

The mouth hooks of third instar larvae belonging to different species of the ***melanogaster*** subgroup are illustrated in figure (4). All eight species are similar in shape and size of the mouth hooks. Although the form and size of the dentition is also similar in six of the species, number and size of the teeth is noticeably smaller in two species ***D. arecta*** and ***D. orena.*** Table (5) gives the mean tooth number for each species. The stocks of the two cosmopolitan species ***D. melanogaster*** and ***D. simulans*** derive from the same geographical location (Nairobi , Kenya) have very similar mean tooth number at 14.5 and 14.9 respectively , which differ from the two endemic island species ***D. mauritiana*** and ***D. sechellia*** ti which they are most closely related . With a mean of 22.9 ***D. mauritiana*** is the species with the largest number of teeth, and ***D. arecta*** has the lowest number (mean5.6). The non-parametric test indicates that the differences between the eight species

are highly significant ($p<0.001$). The analysis of asymmetry is presented in table (6). Although there some variation in the mean coefficient of asymmetry, the differences between the eight species are not statistically significant overall ($H= 13.0$, $P<0.07$).

3- Mouth hooks of European species of *Drosophila* breeding in fungi:

The four of the mouth hooks of five species known to breed exclusively or facultatively in fungi is illustrated in figure (5). The mouth hooks and cephalopharyngeal sclerites are more robust in these species and the dentition is larger. It is interesting that the dentition of ***D. subobscura*** is much smaller than in the other four species. ***D. subobscura*** breeds in fruits, using fungi faculatitavely whereas the others are obligate fungal breeding species (Shorrocks, 1977, 1982).Mean for the tooth number of five species are presented in table (7).Differences between the five means the highly significant ($H= 36$,$p<0.001$) . There are no significant differences among the mean coefficients of asymmetry among the five species (table 8).

Table -1- Mean number of teeth on the mouth hooks of first, second and third instars larvae of ***D.melanogaster.***

Larval stage	means	variances	S.E	n
1st instar	1.75	0.618	0.175	20
2nd instar	5.35	1.50	0.274	20
3rd instar	14.5	25.7	1.134	20

Analysis of stages: Bartlett's test for homogeneity of variance.
Chi-square= 66.0, d.o.f. = 2. $p< 0.001$.
Kruskal – Wallis test (non-parametric analysis).
Value of $H= 44.1$, d.0.f. = 2 $p<0.001$.

Table-2- Mean coefficient of asymmetry for teeth on the mouth hooks of first, second and third instar larvae of ***Drosophila melanogaster*** Nairobi stock.

Larvae stage	mean	variance	S.E	n
1st instar	0.25	0.197	0.099	20
2nd instar	0.12	0.015	0.027	20
3rd instar	0.158	0.046	0.048	20

Analysis of stages: Bartlett's test for homogeneity of variance.
Chi-square=28.9, d.o.f. = 2. $P< 0.001$.
Kruskal – Wallis test (non-parametric analysis). Value of $H= 3.98$, d.0.f. = 2 $p=0.137$

Table-3- Mean number of teeth on the mouth hooks of third instar larvae of ***Drosophila melanogaster*** Sierra Leone inbred strains and massbred population.

Strain no	mean	variance	S.E	n
1	12.1	4.077	0.404	25
2	8.7	7.660	0.554	25
3	12.1	20.06	0.896	25
4	10.7	27.82	1.055	25
5	19.4	17.52	0.837	25
6	13.4	6.583	0.513	25
7	16.0	18.50	0.860	25
8	10.4	12.42	0.705	25
9	12.8	4.690	0.433	25
10	16.3	4.393	0.419	25
11	16.4	10.33	0.643	25
12	16.2	4.639	0.431	25
13	16.4	10.33	0.642	25
14	15.6	48.17	1.388	25
15	14.4	6.340	0.504	25
Mean for 15 lines	13.9	13.57		
Massbred population	14.6	10.80	0.558	100

Analysis of stages:Bartlett's test for homogeneity of variance.
Chi-square=100.6 d.o.f. = 2. $p< 0.001$.
Kruskal – Wallis test (non-parametric analysis).
Value of $H= 149.4$, d.0.f. = 14, $p<0.001$.

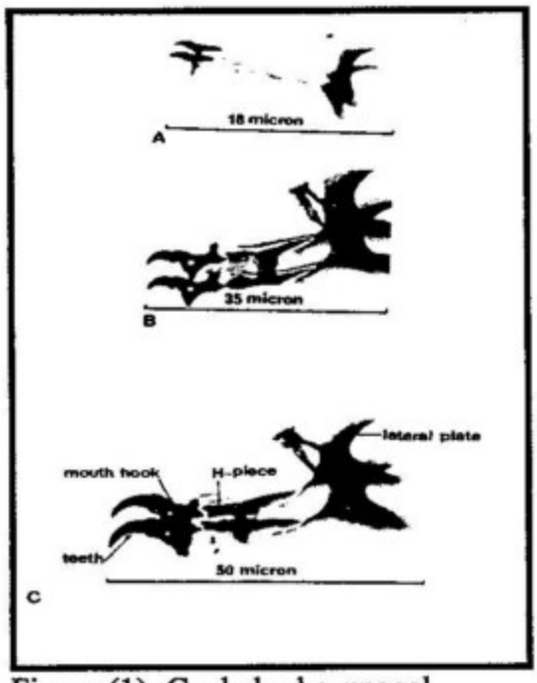

Figure (1) :Cephalopharyngeal sclerites and mouth hooks of *Drosophila* melanogaster. A , first instar , B , second instar , C , third instar ,Unstain preparations mounted in Berles fluid

Figure (2) :Mouth hooks of third instar larvae from the cage population. A, normal morphology. B, three individuals exhibiting asymmetry in the shape of the mouth hooks and dentition

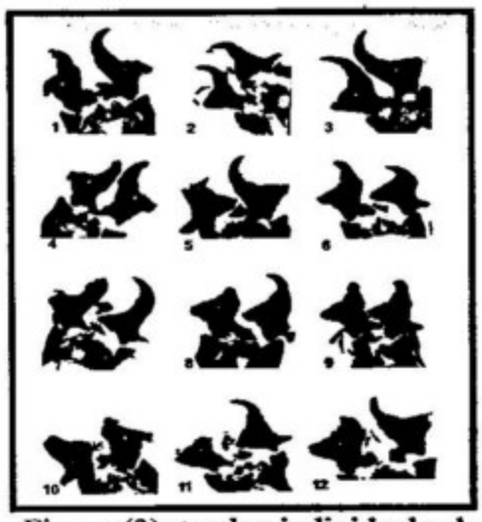

Figure (3): twelve individuals, derived from isofemale lines subjected to close inbreeding for many generations which show various abnormalities of mouth hook morphology including absence of denition (2) , asymmetry of tooth number (3) hemilateraly (7) and bilaterally (10) sever malformation of the mouth hooks. All to the same scale.

Table-4-Mean coefficient of asymmetry for teeth in the mouth hooks of third instar larvae of ***D. melanogaster*** Sirra Leone inbred strains and massbred population.

Strain no	Mean	Variance	S.E	n
1	0.117	0.039	0.039	25
2	0.202	0.03	0.034	25
3	0.456	0.148	0.035	25
4	0.192	0.070	0.53	25
5	0.132	0.045	0.23	25
6	0.127	0.041	0.20	25
7	0.219	0.094	0.051	25
8	0.322	0.135	0.073	25
9	0.147	0.0175	0.027	25
10	0.117	0.039	0.039	25
11	0.073	0.00969	0.019	25
12	0.067	0.0027	0.0101	25
13	0.123	0.013	0.023	25
14	0.241	0.125	0.071	25
15	0.081	0.039	0.040	25
Mean for 15 lines	0.174	0.059		
Massbred population	0.156	0.061	0.025	25

Analysis of inbred lines:

Bartlett's test for homogeneity of variance.

Chi-square=156.9, d.o.f. = 14. P< 0.001.
Kruskal – Wallis test (non-parametric analysis).
Value of H= 40.0, d.o.f. = 14,p<0.001

Table-5-Mean number of teeth on the mouth hooks of third insrar larvae of ***D. melanogaster*** subgroup species. Massbred stocks

Species	Mean	Variance	S.E	n
D. melanogaster	14.5	25.63	1.320	20
D. simulans	14.9	5.313	0.515	20
D. mauritiana	22.9	14.98	0.865	20
D. orana	9.2	11.08	0.744	20
D. erecta	5.6	9.516	0.690	20
D. teisseri	17.2	8.168	0.640	20
D. yakuba	11.7	7.8	0.625	20
D. sechellia	20.4	25.24	1.146	20

Analysis of inbred lines:
Bartlett's test for homogeneity of variance.
Chi-square=753, d.o.f. = 7 P< 0.001.
Kruskal – Wallis test (non-parametric analysis).
Value of H= 108.0, d.o.f. = 7, p<0.001

Fifure(4): Above, cephalopharyngeal sclerites and mouth hooks of ***D. subobscura*** and ***D. testcea*** . Note the havier sclerites of ***D. testcea*** . Below mouth hooks of the five fungal breeding species at higher magnification to show the dentition in grater detail

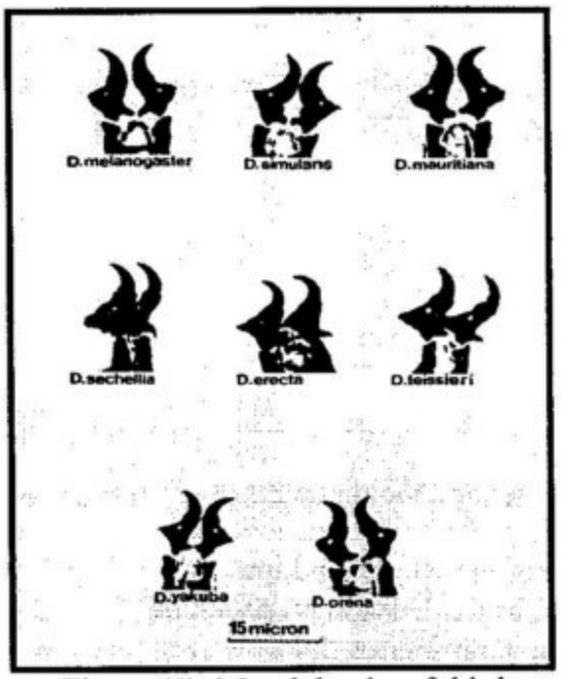

Figure (5): Mouth hooks of third instar larvae of the eight species of the melanogaster species subgroup.

Table -6-Coefficient of asymmetry for teeth on the mouth hooks of ***D.melanogaster*** subgroup species. Massbred stochs

Species	Mean	Variance	S.E	n
D. melanogaster	0.53	0.033	0.041	20
D. simulans	0.116	0.005	0.016	20
D. mauritiana	0.154	0.032	0.040	20
D. orana	0.171	0.014	0.026	20
D. erecta	0.383	0.141	0.048	20
D. teisseri	0.092	0.007	0.019	20
D. yakuba	0.141	0.053	0.051	20
D. sechellia	0.129	0.017	0.029	20

Analysis of inbred lines:
Bartlett's test for homogeneity of variance.
Chi-square=89.7, d.o.f. = 7 P< 0.001.
Kruskal – Wallis test (non-parametric analysis).
Value of H= 13.04, d.o.f. = 7, p<0.071 (n.s.)

Table-7- Mean number of teeth on the mouth hooks of third instar larvae of fungal feeding species. Massbred stocks.

Species	Mean	Variance	S.E	n
D. subobscura	20.2	13.87	0.802	20
D. kunzei	15.5	23.79	0.969	20
D. phalerata	19.9	27.21	1.166	20
D. testacea	12.6	13.25	0.902	20
D. transversa	17.6	7.10	0.596	20

Analysis of inbred lines:

Bartlett's test for homogeneity of variance.

Chi-square=11.9, d.o.f. = 4 P< 0.017.

Kruskal – Wallis test (non-parametric analysis).

Value of H= 36.0, d.0.f. = 4, p<0.001.

Table-8- Mean coefficient of asymmetry for teeth on the mouth hooks of third instair larvae of fungal feeding Drosophila species. Massbred stocks.

Species	Mean	Variance	S.E	n
D. subobscura	0.112	0.0073	0.020	20
D. kunzei	0.174	0.023	0.034	20
D. phalerata	0.133	0.02	0.025	20
D. testacea	0.127	0.010	0.023	20
D. transversa	0.104	0.0087	0.020	20

Analysis of inbred lines:

Bartlett's test for homogeneity of variance.

Chi-square=8.13, d.o.f. = 4 P< 0.087 (n.s.).

Kruskal – Wallis test (non-parametric analysis).

Value of H= 2.60, d.0.f. = 4, p<0.621 (n.s.).

Discussion

Knowledge of the breeding sites of the eight species of the ***Drosophila melanogaster*** subgroup is presently uneven and incomplete. Few breeding sites are known for ***D. mauritiana*** and non ***D. arena*** (Lachasie,***et al*** 1988). These authors, and Lachasie and Tsacas (1983) reviewed the known breeding sites of species. The two cosmopolitan species ***D. melanogaster*** and ***D. simulans*** are known to exploit a wide variety of fruits, and also do the Afrotropical species ***D. teissieri*** and D.yakuba ***D. erecta*** is narrowly associated with the fruits of screw – pine Pandanus candelabrum (Pandanaceae). The island endmic species ***D. sechellia*** are known to breed only on the fruits of ***Morinda citrifolia*** (Rubiaceae). The form of the mouth hooks and size of dentition is very similar in all of the eight species of the subgroup. They are clearly different from the group of four specialist fungal breeding species described in this chapter, but not dissimilar from ***D. subobscura***, which is more generalised in its range of known breeding sites, feeding in fruit for part of the year (Shorrocks, 1982). The mean tooth number however, shows a wider range of values across the ***melanogaster*** subgroup species than was found for the breeders. Fruits vary in their fibrous texture. It would be interesting to known how the fruits of Pandanus and Morinda compare in their respect, since ***D. erecta*** and ***D. sechellia*** are at opposite ends of the range of tooth number values in the subgroup .For the fungal breeders it may be that tooth size rather than tooth number is an adaptation to fibrous fungal tissue, whereas the higher number of smaller teeth of ***D. subobscura*** may be an alternative modification to the same end. The form of the mouth hooks and the shape and size of the dentition of ***D. orena*** certainly suggest that it too breed on fruit. Inbreeding ideas to random fixation in homozygous condition of different alleles at gene loci affecting the larval tooth number. This ideas to an array of 15 Sierra Leone strain means which varies symmetrically around a grand mean closely similar to that of the mass bred cage population . The variances of tooth numbers for

individuals around their strain means also differ significantly across the array of 15 strains. That is, individual are more variable in tooth count in some strains than in others. Since individual larvae within a strain are genetically the same, the within – strain variance the variability due to environmental differences between individuals. A major difference in environment depends on whether a larva developed on the medium when it was fresh or previously worked over by older larvae. If some genotypes are more affected by the environment than others, there is genotype – environment interaction. The inequality of strain variances is a reflection of this. Lateral asymmetry within individual is due to accidents of It reflects the strength of developmental canalisation, which is itself under control (Waddington, 1975). Some genotypes are more strongly canalized than others; Asymmetry in the expression of normally bilaterally symmetrical morphological characters tends to be more obvious in highly inbred strains (Larner 1954). Such asymmetry of expression is always random with respect to the sides. No instance of hemi lateral asymmetry, such that left is consistently larger or smaller than right, appears to be known in ***Drosophila***. The level of asymmetry was found to be similar in massbred stocks of species in the ***melanogaster*** subgroup and the fungal breeding species. However, some of the Sierra Leone inbred strains show an increase in asymmetries, which identifies which are less well canalized, such as SL7, SL 18 and SL33. An interesting question is strains which are more affected by differences in environment between individual represent genotypes which are less well canalized? In some instances this does appear to be so (e.g. SL7 and SL33). The spearman Rank correlation (non-parametric) between coefficient of asymmetry and variance in dentition count for the 15 inbred strains is 0.7 ($p=0.0036$), which strongly supports this hypothesis. The results of this reveal significant differences in mean tooth count between larvae of different members of the ***melanogaster*** species subgroup. The larval dentition could therefore be valuable in certain cases as a taxonomic character for identifying larvae especially if this could be supplemented with other possible morphological characters. For example, larval tooth count might be used to distinguish third instar larvae of either of the two endemic island species ***D. mauritiana*** or ***D. sechellia*** from either of the colonizing cosmopolitan species ***D. sechellia*** from either of the colonizing cosmopolitan ***D. melanogaster*** and ***D. simulans***. Similarly, larvae of the two endemic African species ***D. erecta*** and ***D. orena*** might also be distinguished from either of the cosmopolitan species on the basis of difference in tooth count. Unfortunately, the larval tooth count fails as a diagnostic character in those cases where it could have been most useful for recognizing larvae of species likely to be found in association, for example ***D. melanogaster*** and ***D. simulans*** or the four obligate European fungal breeding species.

Conclusion:

This study emphysized the following facts:

1- The significant differences in mean tooth count between larvae of different member of the melanogaster species subgroup and other species used, and this variance was due to their food resource differences.

2- The larval dentition could be valuable in certain cases as a taxonomic character for identifying larvae, especially if they could be

supplemented with other possible morphological characters.

3- The results of this investigation revealed that, their were more likely a genotype – environment interaction.

Finally this study takes a first step towards examine the proposition that larvae of ***Drosophila*** have the capability to modify the performance of elements of their foraging behaviors in response to environmental conditions.

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دراسة تطورية بيئية للقطع البلعومية والخطاطيف الفمية لأنواع مختلفة ليرقات ذباب الفاكهة

عبد الزهرة كاظم محمد علي •

• مدرس، دكتوراه، قسم علوم الحياة، كلية العلوم، جامعة بغداد

الخلاصة

استخدمت في هذا البحث يرقات انواع مختلفة من حشرة ذباب الفاكهة عائلة **Drosophilidae** لغرض دراسة شكل وتركيب القطع البلعومية الرأسيةوخطاطيف الفم وطبيعة التسنن فيها وعلاقة ذلك مع نوع الغذاء الذي تناولته تلك اليرقات في البيئات المختلفة والتي غالبا ما يعتقد بانها تقع تحت سيطرة جينية محددة . فقد تضمن البحث مقارنة شاملة من خلال استخدام يرقات الطور الثالث التي تم الحصول عليها من المجموعة الأساسية Massbred population والتي نشأت من 15 خطا تكاثريا متماثلاً Isofemale inbred lines مع ثمانية انواع تقع تحت مجموعة ال***melanogaster*** علما ان هذه المجاميع قد تم تربيتها لعدة اجيال في ظروف مختبرية اعتيادية اضافة الى خمسة انواع اعتمدت في غذائها على انواع مختلفة من الفطريات . وقد بينت التحاليل الأحصائية لنتائج هذا البحث ما يلي : 1- هناك فروق معنوية عالية لعدد الأسنان بين الأطوار اليرقية الثلاث المختلفة في ***D. melanogaster***[والذي يعكس النمو الطبيعي للحالة التطورية المتعلقة بحاجة كل طور من الغذاء . 2- وجود فروق معنوية عالية توضح التباين بين الخطوط التكاثرية ، والمهم هنا ان هذا التباين بين هذه الخطوط كان اكبر مما هو عليه في المجموعة التكاثرية الأساسية. 3- وجود اختلافات واضحة بين الأنواع الثمانية التي تقع تحت مجموعة ***Drosophila*** علما ان هذه الأنواع تختلف في توزيعها الجغرافي 4- كانت القطع البلعومية الرئسية cphalopharyngeal sclerites والخطاطيف الفمية mouth hooks تختلف عما هو عليه في الأنواع السابقة حيث تمتاز بالقوة مع كبر الأسنان فيها وهذا ما يؤكد علاقتها مع الغذاء الذي تتناوله وان هناك فروق معنوية واضحة بين تلك الأنواع . 5- لقد تم دراسة تاثير التوارد الداخلي (المختبري) على موازنة اعداد الأسنان الفمية من خلال مقارنة عرض الصفات لكل من افراد المجموعة الرئيسة وافراد الخطوط التكاثرية المتماثلة.وقد تبين خلال البحث وجود تداخل بيني وراثي يلعب دورا مهما في اظهار الصفات المظهرية والتركيبية لأجزاء الفم ليرقات حشرة ذبابة الفاكهة.