

**EXPERIMENTS WITH
DROSOPHILA
AMPELOPHILA
CONCERNING EVOLUTION**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649191017

Experiments with *Drosophila Ampelophila* concerning evolution by Frank E. Lutz

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Cover @ 2017

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WASHINGTON, D. C.
PUBLISHED BY THE CARNEGIE INSTITUTION OF WASHINGTON
1911
2m

CARNEGIE INSTITUTION OF WASHINGTON, PUBLICATION No. 143

PAPER No. 16 OF THE STATION FOR EXPERIMENTAL EVOLUTION AT
COLD SPRING HARBOR, NEW YORK

Copies of this Book
were first issued
MAR 14 1911

THE CORNHAN PRINTING CO.
CARLEISLE, PA.

EXPERIMENTS WITH DROSOPHILA AMPELOPHILA.

THE INHERITANCE OF ABNORMAL VENATION.

THE EFFECT OF SEXUAL SELECTION.

DISUSE AND DEGENERATION.

THE INHERITANCE OF ABNORMAL VENATION.

Practically all the experimental studies of inheritance have extended through but few, rarely more than 6, generations and have been concerned with pairs of non-intergrading characters. In the present work more than 70 generations have been reared. This was possible for two reasons: *Drosophila ampelophila* Loew has a very short life-history, and it can be kept breeding throughout the year. The character abnormal wing-venation, the inheritance of which was studied, may be made to exhibit extreme variability, passing from less venation than normal through normal to extra venation, so great that the additional veins almost equal the normal in extent.

At the Boston (1907) meeting of the International Zoölogical Congress a preliminary report was presented upon this subject, 6 generations having been obtained. During the summer of 1908 a report upon the work (covering about 25 generations) done at the Station for Experimental Evolution was submitted to the Director, but I deferred publication because I wished to test more in detail certain points, especially sexual selection and the further fate of the abnormal strains. This additional work was done at the American Museum of Natural History. Incidentally I obtained confirmation of the previous work, but for the most part the present paper includes only the Cold Spring Harbor data and the conclusions drawn are as given in the 1908 report, except where otherwise indicated.

MATERIAL AND METHODS.

Drosophila ampelophila (the small red-eyed "pomace-fly") is very common about cider-mills, ripe fruit, vinegar-barrels, and the like. The larvæ normally live in the pulp of rotting fruits, especially during the acetic-acid stage of decay. They will, however, thrive on the side of a tumbler containing fruit-juices, and I have reared them through several generations on stale beer. At a temperature of 25° C. the eggs hatch in 40 hours or less. The duration of the larval period is, on the average, 5 days, and of the pupal period 4½ days. The adults become sexually mature about 48 hours after emergence when kept at this temperature. They live for about 3 weeks. The mean number of eggs is close to 200. Copulation is repeated and frequent.

Most of the flies discussed in this paper were bred in an incubator, where an average temperature of 25.5° C. was maintained. A thermographic record was kept. Since the temperature of the incubator was so nearly that of the working-room, absolute constancy was not obtained. The amount of variation is shown in fig. 1, which gives the frequencies

of the different degrees as found during four typical months from readings of the thermogram at 3-hour intervals. For the purpose of these experiments even this approximation to constancy does not seem necessary, as variations of temperature were found to have no influence upon the wing-venation. Therefore the incubator was not used in the latter part of the work.

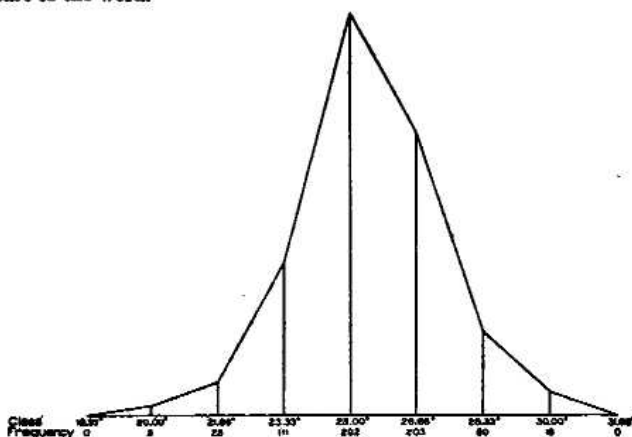


FIG. 1.

Bananas were used as food. They were purchased while still quite green and ripened in glass-stoppered bottles. In this way accidental introduction of wild flies was rendered unlikely. Even had *Drosophila* eggs been laid on the green banana, they would have hatched and the larvæ would have developed into plainly visible pupæ before the banana was used. Frequent control-cultures were kept and in no case was a *Drosophila* found in them. The flies with their food were kept in carefully washed glassware and the instruments used in handling the food were sterilized in an alcohol flame after every operation which could possibly get eggs or larvæ upon them. The importance of this caution can not be too strongly urged upon those who carry out pedigree-work with this insect.

An egg-laying female was given a fresh piece of banana every two days and an effort was made to have all the banana of the same degree of decay. Each piece was kept separate during the growth of the larvæ. This also is important, since, if one merely gives a large supply of food to the female at the start of oviposition, and does not change it, the early-born larvæ will have very different food from those which are born later. The pupæ were picked out of the "larval dish" and placed

upon moist blotting-paper in a small vial, from which the adults could readily be transferred to an etherizing vial as they emerged.

When mating was to be done the sexes were always separated before they were a day old. Usually no female was used as a parent that was more than 12 hours old before being isolated from the males. Numerous tests showed that no females so treated laid fertile eggs. Only rarely was there a difference of more than one day in the ages of the parents, and they were usually mated before they were two days old. For practical reasons, parents were killed after 50 to 100 offspring had been secured. It was found that neither the percentage of abnormal offspring nor the intensity of their abnormalities changed with the age of their parents, so that this procedure was permissible.

In this paper only those families are considered which are in or close to the main line of descent. I have not thought it worth while to include any families having less than 40 offspring unless they were in this main line. Typical data are given in table 36, page 31. I have tried to arrange these so that they will be available for further work by those interested. They should not, however, be used for more than they are worth. For example, one can not study the inheritance of fecundity from them, as in but few cases have I bred from a female until she died a natural death.

All individuals, both parents and offspring, have been kept for reference and are deposited in the American Museum of Natural History. When of especial interest, the wings were mounted on glass slides in a thin layer of paraffin. This was found to be an excellent method of preservation. By all other methods which were tried the veins were rendered more or less transparent. When, as in making matings, it was desired to examine live flies, they were slightly etherized. They completely revive in a few minutes. All examinations for abnormalities in wing-venation must be made with a lens.

Occasionally the larvæ were attacked by a disease (?) of unknown origin which caused them to crawl out of the food, elongate, and die. When this disorder appeared in a dish it was usually fatal to all the larvæ in that dish. Otherwise, *Drosophila* bears confinement very well. Practically all the larvæ which hatch complete their development. My experience confirms the results reached by Castle (1906b) that the closest inbreeding may be practiced with this fly for generations with no injurious results. Such inbreeding was the rule in this work, being necessary in long-continued breeding unless unpedigreed stock be used.

DESCRIPTION OF NORMAL VENATION.

The normal venation of *Drosophila* is extremely simple, as is shown by fig. 2. The costal vein reaches to the fourth of the five longitudinal veins. The auxiliary vein is incomplete or indistinct. The anal cell is present. The discal and second basal cells are united and the first posterior cell is not appreciably narrowed in the margin.