

A B S T R A C T

1. An attempt was made to obtain morphological mutant of Culex pipiens fatigans Wiedemann, the mosquito vector of filariasis, both from wild type populations and from treated and untreated laboratory inbred colonies. There seems to be some controversy with regard to nomenclature, some authors claiming that the name Culex fatigans is synonymous with many others and that the first named is Culex (Culex) pipiens quinquefasciatus Say (1823), but I have used the name Culex pipiens fatigans throughout my thesis. Spontaneously occurring mutants were isolated from two sets of mosquitoes:
 - (a) from wild mosquitoes collected from Katmalana and Ingegoda and then inbreeding them for three generations, and
 - (b) from two laboratory maintained colonies, one maintained in the lab at room temperature and the other 24°C - 25°C (Air conditioned room).

2. In the case of collections from the wild, a female mosquito that had taken a blood meal was collected fortnightly from a house at about 7 a.m. The F₁ generation was observed from larval to adult stages. Ten F₁ females were intercrossed to F₁ males of the same egg raft in ten separate cages. After mating for seven days, the females were starved and a blood meal was given. Ten egg rafts, one from each female was collected separately and the hatchabilities were recorded. The larval to adult stages were observed. The F₂ adults emerging from each such egg raft were then allowed to intercross and their F₃ progeny was very carefully observed from larval to adult stages for morphological and colour deviants after the hatchabilities had been recorded.

3. From this survey I was able to isolate five phenotypically abnormal types. On testing them, two proved to be definite inheritable mutants, namely, knobbed palp (kp) and unisegmented tarsi (ust). Another mutant hooked legs (hl) arose from the F_2 generation of an outcross of the ust mutant. One deviant proved to be a phenocopy and the other two phenotypically abnormal types were lost before definite tests could be carried out on them. The phenotypes of these two were, one affecting the legs and the other the antennae. In the former the first tarsal segment of all 3 legs was swollen compared to those of the normal legs. In the latter, both antennae were distinctly shorter than those of the normal mosquito.

4. In the mutant described as knobbed palps (kp) the palps have a knob shaped projection at the junction of the distal two segments. In the normal mosquito the palps are tapering without any visible projections. This knobbed palp mutant was similar to the clubbed palp mutant isolated by Laven in 1955 from Culex pipiens both in phenotypical expression and in genetic characteristics. Although Laven gave the symbol kps to his mutant I have called it kp. The knobbed palp mutant was found to be due to a recessive, autosomal gene. As it showed expression either in both palps or in one, its expressivity was variable. It showed full penetrance.

5. The second of these mutants, namely, unisegmented tarsi (ust) had only one tarsal segment instead of the usual five. This tarsal segment was shorter than the first tarsal segment of a normal mosquito and it tapered to a point, ending in a single blunt projection. This mutant had not been previously described in the literature, therefore, it has

been given a new name unsegmented tarsi with symbol ust. This mutation was also due to a recessive, autosomal gene and showed variable expressivity and full penetrance.

6. From this ust colony arose another phenotypically distinct tarsal mutant where all the tarsal segments though present had the fourth tarsal segment of the third pair of legs curved giving a hooked appearance to these legs. Analysis showed that this was also due to an autosomal recessive gene. In all the genetic tests for this mutant there was always ust mosquitoes, along with the hooked leg individuals in the F_2 generation and in the backcross. It was suspected that this hooked leg mutation was pseudo - allelic to ust and had arisen by unequal crossing over at the ust locus. But before this idea could be tested, the colony was lost.
7. In addition to the above surveys carried out for the isolation of naturally occurring mutants from the wild, two inbred colonies were maintained in the laboratory, one at room temperature ($27^{\circ}\text{C} - 29^{\circ}\text{C}$) and the other in an air conditioned room ($24^{\circ}\text{C} - 25^{\circ}\text{C}$). In the twenty first generation of the colony maintained at room temperature, a mutant was detected which had rough eye (re), this phenotype had not been described for Culex pipiens before. However, a similar phenotype had been described for Culex tritaeniorhynchus for which the name rough eye and symbol re had been given.

In the mutant I discovered the rough eye was darker and lacked the greenish lustre that is found in the normal eye. Normal mosquitoes have eyes that are greenish tinged dark brown in colour. In addition to this colour difference from the normal, the corneal surface of

the eye, instead of showing the smooth and clear separation of regularly arranged ommatidia, appeared fused in patches and, therefore, gave a black and rough appearance to the surface of the eye. These patches varied in size. Genetic tests did not give a clear 3:1 ratio or 1:1 ratio expected for an intercross and a backcross respectively for a recessive gene. The observed values departed significantly from the expected. It is hypothesised, however, that this mutant gene is recessive and probably ^{linked to the sex gene} and that the departure from expected ratios is due to (a) mortality of the homozygous mosquitoes and (b) incomplete penetrance.

8. Recovery of heterozygously existing mutations from wild populations enabled us to detect frequencies in such populations for Culex pipiens fatigans in and around Colombo, which have been sampled by us. I have obtained a frequency of 0.06 mutation/individual. If the two aberrant mutations that were lost before testing were considered as true mutants and if they are also included then the mutation frequency becomes 0.12 mutation/mosquito. Then the frequency obtained for wild population from Sri Lanka approximates that of 0.16 mutation/mosquito obtained by VandeKey in 1969 from Germany.

Similar frequencies for other mosquitoes, particularly Aedes aegypti, are much higher. It is hypothesised that this difference in mutations/individual between Culex pipiens and Aedes aegypti is due to differences in their egg laying habit, Culex pipiens laying one single egg raft of 100 - 200 eggs at a time whilst Aedes lays a few eggs separately at a time.

9. Irradiation (X-rays) and chemical (Ethyl methane Sulphonate, fluoro uracil and thietopa) treatment were also used to obtain mutants. No morphological or colour mutants were obtained. This may be because the induction of visible mutations is generally very rare in most organisms. The few that had been recorded elsewhere as arising from treatment may have actually been pre-existing or spontaneously arising ones.

10. This project was started with the hope of building up mutant stocks of the mosquito Culex pipiens fatigans, Meigen the vector of human filariasis in Sri Lanka, from which special tester stocks could be built up, for the detection of translocations and lethal mutations which translocations were to have been used eventually in genetic control programmes of the mosquito. However, in April 1978 when I had completed only the experiments reported in this thesis, all my mosquito colonies got wiped out for some reason, may be the climatic conditions prevailing at that time or some other cause.