THE LACK OF AUTOLYSIS OF THE FLIGHT MUSCLES OF *AEDE[S] COMMUNIS* (DE GEER) (CULICIDAE) IN THE LABORATORY

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Many authors have commented on the mystery of the nitrogen source for egg development in the very plentiful northern species of mosquitoes. Surveys of possible blood sources in comparison to the hordes of blood-sucking female mosquitoes have led to the idea that mosquitoes in the north must be capable of developing eggs without blood meals. In my laboratory at Ft. Churchill, Manitoba, Canada, repeated efforts have been made to obtain eggs from blood-sucking females denied a protein food source but maintained on sugar solutions or raisins alone; no instance of egg development or oviposition has occurred.

Hocking, in 1952 reported the progressive autolysis of the flight muscles of a series of field collected specimens of a mosquito believed to be *Aedes communis* (De Geer) from the Ft. Churchill, Manitoba region. The autolysis proceeded as the eggs formed in the ovaries. He postulated the autolysis of these muscles to provide a source of protein for the development of the eggs.

In 1949 (unpublished) I discovered that *Aedes communis* from the Ft. Churchill region was capable of developing and ovipositing viable eggs with a food source of sucrose or raisins alone. Furthermore, no efforts would induce this species to take a blood meal in the laboratory nor were any observations made of positively identified *Aedes communis* females taking blood meals in the field. The specimens Hocking observed were collected, as would be expected with this non-attracted species, in sweeps made in the grasses around pools known to breed numbers of *Aedes communis* larvae. The specimens were tentatively identified as *Aedes communis* and there is no reason to believe that they were other than this species.

The reported autolysis was of intere[st] to me, particularly since it appeared t[o] give evidence of a possible egg develo[p]ment without blood in northern mo[s]quitoes, and also because progressive aut[o]lysis would afford an admirable oppo[r]tunity for study of flight characteristics a[s] the muscles disappeared. Therefore in th[e] laboratory, a number of *Aedes commun[is]* females were permitted to emerge fro[m] field collected pupae, were fed on sucros[e] alone, and each day a sample was remove[d] and the living insects were killed an[d] fixed immediately in Carnoy's fixativ[e]. The last sample was observed to hav[e] fully developed eggs in the ovaries; an[d] eggs were being laid in the cages. Bu[t] some of the gravid females were noted t[o] be capable of flight. The samples wer[e] examined for muscle autolysis by sectio[n]ing and by gross dissection. No sign o[f] reduction or histological abnormality i[n] the flight muscles was noted, even in th[e] specimens with fully developed egg[s]. Comparisons were made with the *Aed[es] communis* newly emerged and with *Aed[es] hexodontus* Dyar. Figure 1 presents [a] photograph of an *Aedes communis* femal[e] with eggs fully developed and shows a fu[ll] complement of flight muscles.

Dr. Hocking, by personal communica[]tion (1954), has suggested that perhap[s] the non-autolysing specimens were a di[f]ferent form of *Aedes communis* fro[m] those that he observed. In 1950 h[e] showed two peaks in the graph of pr[o]boscis to wing length ratio of adult fe[]males of *Aedes communis* in the Churchi[ll] region and this suggested the presence o[f] two forms. Dr. Hocking has informe[d] me that the proboscis to wing length rati[o] of the specimens in which he observe[d] autolysis was .738 ± .029. The same rati[o] for 25 of the specimens showing no aut[o]

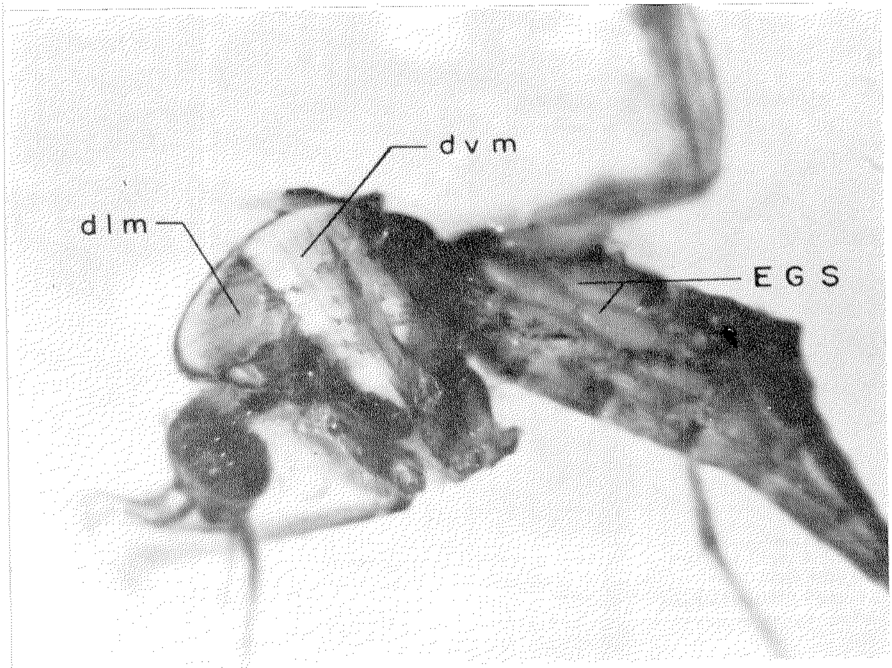

FIG. 1. A whole mount of an *Aedes communis* female dissected to show the fully developed eggs (EGS) and the flight muscles, the dorso-ventrals (dvm) and the dorso-longitudinals (dlm).

ysis in my laboratory was .721 ± .027. This mean falls well within the same peak as that of Dr. Hocking's and not near the peak of the postulated other form of *Aedes communis* which has its mean at approximately .85.

It appears that autolysis of the flight muscles is not the answer to the development of the eggs in *Aedes communis* in the laboratory. We are left with the "fat body" and the autolysis of other muscles as possible protein sources. Roubaud (1932) has reported the presence of larval muscles in recently emerged *Culex* adults and I have observed similar muscles in *Aedes communis*. These muscles disappear rapidly after emergence; and egg development is noted as the disappearance takes place. Circumstantially one might expect, as suggested by Roubaud, that the histolysis of these muscles contributed some protein for use in egg development. It may actually trigger development. I have sectioned recently emerged *Aedes hexodontus* adults and have observed similar larval muscles. Rapid disappearance is also the case in this species, but the histolysis does not contribute to egg development because no egg development is observed in adults which have not had a blood meal.

Both *Aedes communis* and *Aedes hexodontus* have extensive "fat body" on emergence and whereas *Aedes communis* may use the stored protein from this source for egg development it does not seem to be available to *Aedes hexodontus* without benefit of at least a blood meal.

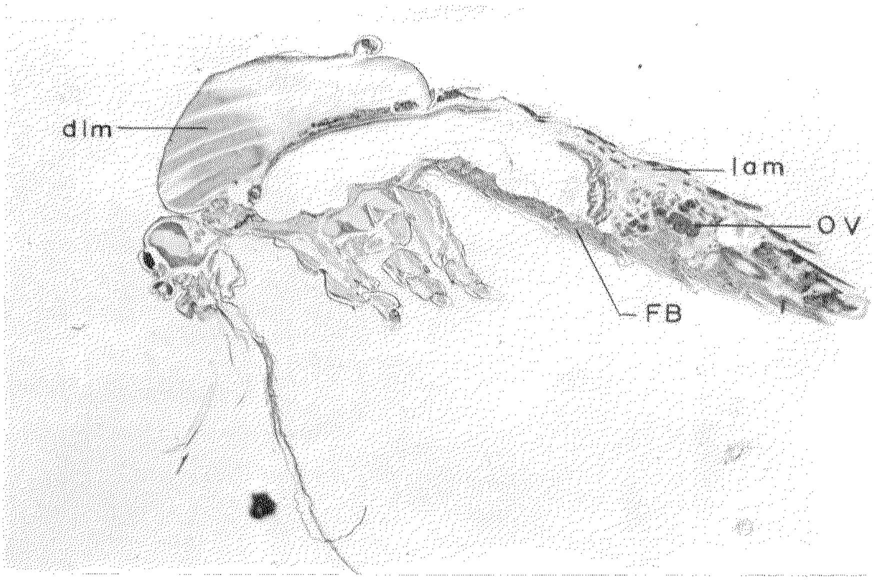

FIG. 2. A sagittal section of an *Aedes communis* female, recently emerged, showing the dorso-long tudinal flight muscles (dlm), the larval muscles (lam), the extensive fat body (FB) and the und veloped ovaries (OV).

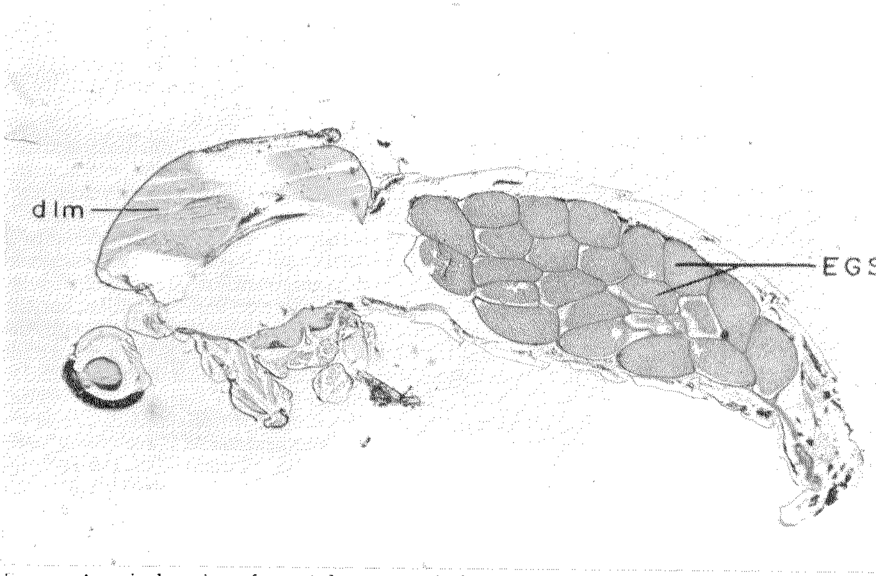

FIG. 3. A sagittal section of an *Aedes communis* female, with eggs (EGS) almost completely d veloped, with larval muscles absent, with a much reduced fat body but with the dorso-longitudin flight muscles (dlm) intact.

ertainly the physiology of egg production 1 the two species appears to be quite different. Figure 2 shows a specimen of *tedes communis,* recently emerged, with orsal longitudinal flight muscles, larval uscles and extensive "fat body." Figure shows another specimen of *Aedes comunis* with eggs almost completely developed. The dorsal longitudinal flight uscles are present. Of particular interest is the reduction of the "fat body" nd the absence of larval muscles which ave long since histolysed. The "fat ody" of *Aedes hexodontus* also becomes educed with age; however no egg production takes place without blood. In the blood-sucking species we must still continue to consider blood meals as the most probable source of protein for egg development.

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SIMPLE LARVAL AND ADULT MOSQUITO INDEXES FOR ROUTINE MOSQUITO CONTROL OPERATIONS

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Few of the numerous methods used at resent to obtain an index of larval or dult mosquito populations in routine nosquito control operations are satisfacory or reliable. While engaged in entonological phases of mosquito control perations in the Solomon Islands in 943–1945 I used a simple index which ppeared to be quite reliable and required minimum of work for the field personel. Recently this method has been tried n a limited scale in California with satisactory results. Therefore it seems advisble to bring it to the attention of persons ngaged in mosquito control operations.

It is a well known fact that mosquito opulations, both adult and immature tages, are not dispersed at random but ccur in concentrations over a wide and ariable area. The difficulty with most nethods of estimating mosquito populaions, such as the popular "average per lip" index for larval populations and the "mosquitoes per hour" or per man-hour for adult populations, is that only one of these variables is taken into account. In developing our simple index we therefore attempted to include both factors of density and extent or spread of the population. Essentially the method consists of standardizing the unit areas to be sampled, measuring the density for each unit area and combining this information into an index. No originality is claimed for this idea but it appears that it has not been widely applied to developing an index suitable for mosquito control operations.

Breeding Index (BI). The breeding index as developed by us is particularly adapted to anopheline breeding in situations where the larval breeding places consist of small, temporary pools as well as streams and other permanent bodies of water, and where there is a considerable fluctuation in the number and extent of breeding sites. With slight modifications