operated for a total of 14 wk are shown in Table 1. There appears to be little difference between oviproductivity of the two colors. However, it should be noted that in both instances, the same number of eggs were collected and that between 17 and 20 percent of the paddles were positive. The highest number of paddles positive for any one week was 9 for the black painted trap during the week of 21 May 1982 and 10 for the red container obtained during the week of 9th July 1982.

The multi-paddle ovitraps were set by Dr. A. B. Knudsen (personal communication) near coral rock holes in Anguilla, W. I. to determine whether the *Aedes aegypti* breeding in the cavities could be induced to oviposit in artificial containers (Parker et al. 1983).

Table 1. Results obtained for two multi-paddle ovitraps one painted black and the other red over a period 14 weeks at Chaguaramas, Trinidad, 1982.

	Black ovitrap	Red ovitrap
No. paddles examined	168	168
No. paddles positive	28	34
No. eggs collected	321	321
Percent paddles positive	16.7	20.0
Mean no. eggs per positive paddle	11.5	9.4

Four traps, each containing 12 paddles were exposed for 72 hours. One of the traps was overturned, but the other 3 contained *Ae. aegypti* eggs. In one of the traps 6 of the 12 paddles yielded eggs. The number of eggs recovered per paddle ranged from 4 to 20 or more.

These multi-paddle ovitraps very considerably increase the surface area for egg deposition and thus possibly mimic more closely a real tree hole. They can be very useful in collecting large quantities of eggs with less effort than the conventional ovitrap.

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ABDOMINAL PULSES IN NEWLY EMERGED MOSQUITOES, *AEDES AEGYPTI*

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Extracardiac pulsatile organs have been known in insects for about 150 years (Wigglesworth 1953, Jones 1964). Hitherto, however, such organs have been found only in the head and thoracic regions, where they aid in the circulation of haemolymph in particularly active sites such as the antennae, legs and wings, and at particularly critical times as when the wings are expanding after eclosion. I now report the finding of what appear to be two *abdominal* pulses in the newly emerged mosquito, *Aedes (Stegomyia) aegypti* (L). These were discovered during a study of the highly vulnerable stage of transition from an aquatic to an aerial mode of life. The pulses, which were present in all of the 240 insects studied, are active only during the first minute of adult life; they are presumably associated in some way with the vital redistribution of fluid at this critical time.

Two pulsatile organs are already known in mosquitoes: Jones's scutellar organ in the thorax (Jones 1954), which is similar to the scutellar organs previously described in higher Diptera (Thomsen 1938) and Clements's paired antennal ampullae in the head (Clements 1956), which are similar to the antennal pumps in certain other insects. The newly discovered pulses can be seen clearly at two discrete points on the posterior margin of the VIIIth abdominal segment, ventral to the midline; this segment, like the rest of the abdomen, is greatly swollen at the time of eclosion. The two pulses, which have a frequency of >5 sec^{-1}, may be active continuously or pulsate in bursts of a few seconds at a time. Occasionally the left or right pulse is more active than the other (Fig. 1).

As an essential part of the mechanism of eclosion, the emerging adult inflates itself with air and water which allows the insect to expand itself free from the unyielding pupal integu-

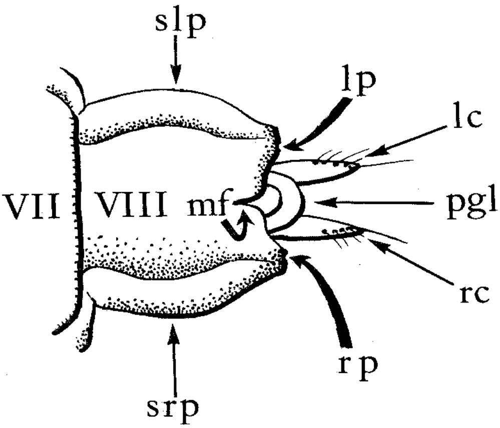

Fig. 1. Ventral view of the greatly inflated VIIIth abdominal segment of a newly emerged adult female *Aedes aegypti* < 1 min after eclosion. lc, left cercus; lp, position of left pulse; mf, median fissure; pgl, postgenital lobe; rc, right cercus; rp, position of right pulse; slp and srp, swollen left and right pleural membrane, respectively.

ment (Gillett 1983a, 1983b). Having escaped, however, the insect finds itself wholly unsuited for life in its new medium; the midgut is distended with air and the whole abdomen is heavy, swollen and unaerodynamic in shape. The pleural membrane of the abdomen, that in mature unfed adults is tucked away beneath the overlapping tergites and sternites, bulges out like the built-in fender surrounding an inflatable rubber dinghy. The abdomen has a flattened, bloated, maggot-like appearance very different from the more or less rigid and streamlined zeppelin shape in the mature insect (Gillett 1983a). Within a minute of freeing itself from the pupa, the greatly enlarged VIIIth segment in *Ae. aegypti* shrinks and becomes barely visible beneath the VIIth. It is during this critical minute that the two pulses are conspicuous. Once the segment has shrunk they cease or, as a result of the reduction in internal pressure, become no longer visible.

The pulses occur in both sexes of *Ae. aegypti* and their presence has been confirmed in *Ae. (Stg.) katherinensis* Woodhill (5/10 insects examined), *Ae. (Finlaya) togoi* (Theobald) (2/8) and *Culex (Culex) molestus* Forskal (1/10) but in these the pulses are far from being conspicuous; they tend to be spasmodic and are usually confined to one side at a time. So far, similar pulses have not been seen in *Anopheles* (0/10). It may be mentioned that the occurrence of these pulses in other species was most frequent in *Ae. katherinensis,* which, like *Ae. aegypti,* is classified as belonging to the subgenus *Stegomyia* but the numbers are very small. In *Ae. aegypti,* the pulses can be seen clearly in natural, unanesthetized insects; they are even more conspicuous when the internal pressure has been increased by hyperinflation of the midgut after exposing the insects to CO_2 (Gillett 1983b). Shortly after the pulses cease, or occasionally while they are still active, the insect begins to excrete clear fluid (Jones and Brandt 1981, Gillett 1983a); the fluid is lost at a rate of about 30–40 nl min^{-1}, depending on size (Gillett, in press). Ten minutes later the insect is able to make its first, teneral flight taking it to a place of refuge where development can continue (Gillett 1983a).

I suggest that the paired abdominal pulses are the outward evidence of pulsatile organs. I am grateful to Professor Jack Colvard Jones (personal communication) for suggesting that these organs are probably dorsoventral muscles within the VIIIth abdominal segment. Although their activity appears to be of very short duration it probably makes a nonetheless important contribution to the successful adjustment for life in the new medium. In the mature adult, of course, water conservation becomes vitally important but in the neoemergent rapid water loss is essential. Abdominal pulses may well exist in other insects but the transitory nature of these pulses (< 1 min) perhaps accounts for their having escaped detection till now, even in the much studied *Ae. aegypti.*

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RECENT INTRODUCTION OF *AEDES AEGYPTI* IN BERMUDA

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Bermuda is an archipelago of approximately 21 square miles (59 km²) located between 32° 15′ and 32° 23′ N and 64° 38′ and 64° 53′ W in the Atlantic Ocean. The nearest point of land, due west, is Cape Hatteras, North Carolina about 600 miles (965 km) away. The 'island' consists of a series of limestone deposits covering the top of an ancient volcano. There are no fresh water streams although a number of marshes and ponds (fresh and brackish water) exist in various parts of the island. The climate is subtropical with an annual average temperature of 70.3°F (21.3°C). The average annual rainfall is approximately 58″ (147 cm) and fairly uniform throughout the year. In a typical year relative humidity ranges from a minimum of 74% in December to 81% in June.

Mosquito control is a function of the Department of Health which uses an integrated approach involving sanitation inspections, elimination of breeding sites, larviciding, larvivorous fish and source reduction in the marshes and ponds where possible. Space spraying or fogging are infrequent procedures.

Species of mosquitoes which occur in Bermuda are *Aedes sollicitans* (Walker), *Aedes taeniorhynchus* (Wied.), *Culex quinquefasciatus* Say and *Culex salinarius* Coq. Bermuda has been considered free of *Aedes aegypti* (Linn.) for 30 years[2] and the last reported major outbreaks of disease associated with this vector were the dengue fever epidemic in 1941 (Tucker 1982, Wilkinson 1943), and yellow fever in 1864 (Hughes-Hallett 1954). Two minor outbreaks of yellow fever were also recorded in 1867 and 1879 (Hughes-Hallett 1954).

Aedes aegypti reinfestation and upsurge in certain Caribbean and Central American regions, as reported by the Pan American Health Organization and the Caribbean Epidemiology Centre (CAREC) in their news bulletins, prompted the Health Department to monitor for the possible reintroduction of the species by aircraft landing in Bermuda from infested countries. This commenced in May 1980 when 15 ovitraps were placed at various locations in and around the Civil Airport buildings. Each trap was numbered and its location marked on a map of the airport environs.

A Department of Health mosquito control operator was assigned the responsibility of making weekly inspections of the traps, collecting paddles for microscopic examination, cleaning and adding water and new paddles to the jars, providing new jars if needed and submitting an ovitrap report form detailing conditions and problems associated with the traps.

In May 1982, Dr. Bruce Knudsen of the Pan American Health Organization undertook a review of the Department's mosquito control activities. On his advice several ovitraps at the airport were moved to more favorable locations. Additional ovitraps were set up at the airport catering complex (some distance from the terminal buildings) and at St. George's Harbour some 2½ miles (4 km) from the airport.

Out of a batch of paddles microscopically examined on September 7, 1982, two were positive with light infestations of *Ae. aegypti* eggs. Both paddles were from traps located inside the airport freight shed which is adjacent to the runways. One paddle was forwarded to CAREC for their confirmation of *Ae. aegypti* eggs and the other paddle was submitted to Dr. I. W. Hughes, Department of Agriculture, Bermuda. Both authorities confirmed *Ae. aegypti* after rearing the eggs to adults.

Following the finding of the positive paddles, a detailed search of the interior of the freight shed and surrounding area was instituted. A small container of water was discovered which contained mosquito larvae. These were identified as *Ae. aegypti* and subsequent adult rearing confirmed this. It was surmised that the reintroduction of *Ae. aegypti* had occurred from infested Caribbean or Central American air freight containers which are taken inside the freight shed for unpacking.

Eradication and control measures were put into force by the Health Department immediately following discovery of the positive paddles on September 7. These measures included:

a) Government departments having airport responsibilities, the U.S. Navy and airline oper-

[1] Chief Environmental Health Officer.

[2] Dr. Egberto Garcia, Report on a visit to Bermuda, August 1972, Pan American Health Organization. Ref. AMRO-2300.