quence in the transmission of dengue, but these populations will pose problems for vector control and eradication programs.

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LARVAL *AEDES AEGYPTI* FROM TUVALU PAPAYA TREES

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Formerly called the Ellice Islands, Tuvalu comprises 9 low-lying atolls totalling some 26 km² in land area; strewn across (5–11°S, 176–180°W) about 1.3 million km² of the Pacific Ocean. This note concerns observations from Phases 1 (Oct.–Nov. 1981) and 2 (April 1982) of a project, supported by the International Development Research Centre and the Memorial University of Newfoundland, and sponsored by the South Pacific Commission. The goal is an integrated control methodology to suppress the vector of Dengue Hemorrhagic Fever (DHF), *Aedes aegypti* (Linn.) (Laird et al. 1982). A full report will follow the completion of Phase 3, early in 1983.

On Funafuti (the group's most populous island, and administrative center) in Phase 1, and on Vaitupu in Phase 2, the DHF vector was recorded from uncharacteristic larval habitats. In particular, it was found to be breeding in the hollow core of papaya (or pawpaw, the commoner South Pacific name) trunks. *Carica papaya*, originally from tropical America (as *Ae. aegypti* hailed from tropical Africa), is now virtually wordwide in the warmer countries, where its fruits are greatly esteemed as are those of the banana. Both the banana and papaya flourish above the slightly brackish ground water that otherwise supports only the staples of coconut, taro and pandanus. The papaya is particularly treasured as one of the world's fastest growing trees and bears fruit when one year old. The delicious, juicy fruit are clustered at the base of the burst of deeply lobed leaves at the top of the hollow trunk (Hargreaves and Hargreaves 1970).

It has long been known that when the soft stem is "perforated by insect or other agency" it "becomes a source of mosquito breeding, which is apt to escape notice" (Dalziel 1937). Although the latter author was writing of West African plantings, he also referred to assertions from China and Mauritius that *C. papaya* has mosquito-repellent properties. This belief had, however, been discounted by Sergent and Sergent in Algeria (1903). Considering the common peridomestic status of papaya throughout the tropical world, it seems surprising that the suitability of that hollow trunk (Fig. 1) for immature stages of *Aedes aegypti* has escaped notice.

One wounded trunk, with a glint of water showing a few centimeters down, was investigated on Funafuti on 15 October 1981. The water was slightly yellowish and the pH was 7.5. Its electrical conductivity was 2300 uS. Four *Aedes (Stegomyia)* larvae were pipetted from it. One was the common Polynesian "bush mosquito," the Bancroftian filariasis vector, *Aedes polynesiensis* Marks. The other three were *Aedes aegypti*. In this as in all other instances now reported, high-

Fig. 1. Papaya trunk, Funafuti, Tuvalu, after chopping into the central cavity to sample aedine larvae.

power microscopy was used to confirm all identifications. These were based upon the comb scales—those of *Ae. aegypti* bearing jagged denticles at the base of the apical spine, and those of *Ae. polynesiensis* being basally fringed. In April 1982, a similar record was made for the island of Vaitupu, a dozen larvae of each of the two species were identified.

One must ask, just *how* common a site for the now-circumtropical "domestic-container" breeding strain of *Ae. aegypti*, is that hollow core of the *Carica papaya* stem? Recollecting the World Health Organization's efforts to eradicate this mosquito from tropical American countries in the 1960's, when resurgences were blamed upon accidental reimportations from careless neighboring countries, one is tempted to wonder if, perhaps, there were slowly reconstituting populations based upon the minuscule overlooked percentage of the population in such cryptic "natural" and therefore ignored larval habitats as this? On discussing the question with colleagues at the joint meetings of the Entomological Societies of America, Canada and Ontario at Toronto (29 Nov.–3 Dec. 1982), one of us (M.L.) learnt from Dr. James E. Hudson of Letchworth, England, that in June 1982 he drew larvae (which were not specifically identified as those of *Ae. aegypti)* from the water-filled core of a papaya trunk at Paramaribo, Suriname. This was in the immediate proximity of his house, where *Ae. aegypti* was far and away the dominant mosquito.

The Tuvalu findings imposed a change in the integrated control methodology that was being planned. Clearly, the continuing production of *Ae. aegypti* from so cryptic a habitat (and it was clear that Tuvaluans were unlikely to welcome an edict to destroy their papaya trees, as part of the preliminary sanitation campaign aimed at source reduction of the DHF vector) was going to prejudice the success of what had been seen as an integrated control methodology based upon sanitation and several biocontrol approaches. These fears were confirmed when *Ae. aegypti* was also found to be breeding in the meter-long valves of giant clam (*Tridacna deresa*) shells on Funafuti, and even in half-coconuts (from which the "meat" had admittedly been scraped) on Vaitupu. The chances of survival of a decimated stock of *Ae. aegypti* seemed only too real, unless a residual chemical was applied to every household on the Phase 3 experimental atoll, Funafuti, in an attempt to kill adult *Ae. aegypti* continuing to enter dwellings, albeit in trivial numbers, following the exhaustive application of *Bacillus thuringiensis* serovar. *israelensis* (Teknar™, Sandoz Inc.) and Altosid™ (Zoecon's briquette version of the insect growth regulator, methoprene) to the island's total drinking water supply.

There is an intriguing aspect to all this which merits further consideration. The white sap that exudes from wounded papaya trees contains a protein-dissolving enzyme (papain) that acts, like pepsin, as a digestive aid (de Wit 1963). Could this be an attractant to ovipositing *Aedes aegypti?*

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EXPERIMENTAL LARVICIDES TESTED IN RICE FIELD PLOTS AGAINST *PSOROPHORA COLUMBIAE*[1]

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Two experimental compounds identified in preliminary laboratory studies as potential larvicides were tested against the rice field mosquito, *Psorophora columbiae* (Dyar and Knab). These were: Rohm and Haas RH-0994 (0-[4-[(4-chlorphenyl)thio]phenyl]0-ethyl S-propyl phosphorothioate) supplied as a 480 g AI/liter emulsifiable concentrate and FMC-45806 (cyano(3-phenoxyphenyl) methyl 3-(2,2-dichloroethenyl)-2,2-dimethyl cyclopropanecarboxylate) supplied as a 297 g AI/liter emulsifiable concentrate. In addition, temephos formulated in plastic ribbons and flakes for slow release (Environmental Chemical, Inc., Barrington, IL) was tested for long term larval control. This report covers studies that were conducted in 1980 at the Arkansas Agricultural Rice Branch Experiment Station in Stuttgart, Arkansas.

MATERIALS AND METHODS

Each test plot was approximately 6.1 × 6.1 m from levee center to levee center. Water was maintained at

[1] This paper reports the results of research only. Mention of a pesticide in this paper does not constitute a recommendation for use by the U.S. Department of Agriculture nor does it imply registration under FIFRA as amended. Also, mention of a commercial or proprietary product does not constitute an endorsement of this product by the USDA.

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