cently ejected the virus while feeding on a carbohydrate source and the virus has yet to be replenished into the salivary duct, and (3) there might be a "salivary gland escape barrier" which prevents virus leaving these glands. This would be the situation when the production of infectious virus has been modulated to low levels. Such an escape barrier could explain the lowered transmission rates which have been obtained after prolonged incubation periods (McIntosh and Jupp 1970, Mangiafico 1971).

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TOXORHYNCHITES MOCTEZUMA, A POTENTIAL BIOLOGICAL CONTROL AGENT IN TRINIDAD AND TOBAGO, W. I.[1]

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Toxorhynchites moctezuma (Dyar and Knab) [as *theobaldi* (Dyar and Knab) in Knight and Stone (1977)] has a wide distribution from Mexico in Central America to Venezuela in South America (Rubio et al. 1980; S. J. Heinemann, personal communication). In the Caribbean Basin, it has a limited distribution and is found only in Trinidad and Tobago (Heinemann et al. 1980). It should be noted that *Tx. theobaldi* is now considered a synonym of *Tx. moctezuma* (S. J. Heinemann, personal communication).

In Trinidad and Tobago, three *Toxorhynchites* species have been recorded. *Toxorhynchites moctezuma, Tx. iris* (Dyar) [as *mariae* (Bourroul) in Knight and Stone (1977)] and *Tx. superbus* (Dyar and Knab), of which *Tx. iris* and *Tx. superbus* are found primarily in terrestrial and epiphytic bromeliads (Heinemann et al. 1980). *Toxorhynchites moctezuma,* on the other hand, has been collected from bromeliads, treeholes, in tires and cans (Heinemann et al. 1980, Chadee et al. 1984).

In 1976, the Insect Vector Control Division (IVCD) of the Ministry of Health and Environment embarked on an *Aedes aegypti* (Linnaeus) Eradication program in Trinidad, W.I. Tobago, however, is relatively free of *Ae. aegypti* but routine vigilance surveys are still conducted twice yearly (Chadee et al. 1984). During surveys, larvae and pupae of *Tx. moctezuma* were collected in artificial containers in both Trinidad and Tobago. All immature stages were collected and transported to the IVCD laboratory, St. Joseph, Trinidad, where they were subsequently identified by the author.

Table 1 summarizes the total collection of *Tx. moctezuma* from artificial containers in Trinidad

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Table 1. Summary of the collections of *Toxorhynchites moctezuma* in artificial containers in Trinidad and Tobago 1983–84.

Stages found (instars)	No. of samples	Type of container	Localities	Date	Other species
Larvae (3)	3	Tires	Flanigan Town, Trinidad	Nov. 9, 1983	*Ae. aegypti*
Larvae (4)	5	Water drums	Flanigan Town, Trinidad	Feb. 13, 1983	*Ae. aegypti*
Pupa	1				
Larvae (4)	5	Water drums	La Canoa, Trinidad	Feb. 17, 1984	*Ae. aegypti*
Larvae (2)	1	Bucket	La Canoa, Trinidad	Feb. 12, 1984	*Ae aegypti*
Larvae (4)	2	Water drum	Belle Garden, Tobago	Jan. 20, 1983	*Lm. durhamii* and *Cx. quinquefasciatus*
Larvae (4)	4	Water drum	Delaford, Tobago	May 20, 1983	*Cx. quinquefasciatus*
Larvae (3)	4	Cans	Pembroke, Tobago	Jul. 3, 1984	—
Larvae (2)	2	Cans	Calder Hall, Tobago	Jul. 19, 1984	—
Larvae (3)	5	Tires	Bacolet, Tobago	Aug. 14, 1984	—
Larvae (4)	2	Basins	Golden Grove, Tobago	Aug. 15, 1984	*Ae. berlini*
Larvae (3)	4	Water drums	Bethel, Tobago	Aug. 16, 1984	*Cx. quinquefasciatus*
Larvae (2)	6	Water drums	Goodwood, Tobago	Aug. 26, 1984	—
Larvae (2)	3	Cans	Patience Hall, Tobago	Aug. 26, 1984	*Lm. durhamii*
Larvae (2)	3	Water drums	Goodwood, Tobago	Oct. 1, 1984	—
TOTAL	50				

and Tobago. The results indicate that the most frequently used artificial containers by ovipositing females were water drums (60%), followed by cans (18%), tires (16%), basins (4%) and buckets (2%). From a total of 50 positive containers, 40% had *Tx. moctezuma* immatures alone. However, the type of containers with pure cultures of *Tx. moctezuma* were water drums, tires and cans, suggesting that all alternate prey had been eaten. From the data collected, the frequency with which prey and predator species were found together was 60%. In addition, four associated mosquito species were collected, namely, *Ae. aegypti* in Trinidad and *Culex quinquefasciatus* Say, *Limatus durhamii* Theobald and *Ae. berlini* Schick in Tobago.

Larvae of *Toxorhynchites* are especially predaceous on the immature stages of other mosquitoes (Steffan 1975). In the United States and in St. Maartin, W. I., laboratory and field trials have been conducted on the use of *Toxorhynchites* mosquitoes to control *Ae. aegypti* populations (Gerberg and Visser 1978, Focks et al. 1982, 1983; Schuler and Beier 1983).

The collection of *Tx. moctezuma* in both natural and artificial containers in Trinidad and Tobago suggests that *Tx. moctezuma* utilizes a wide range of containers varying not only in size and water holding capacity but also in the diameter of the exposed water surface. Moreover, the collections of *Tx. moctezuma* from tree holes, terresterial and epiphytic bromeliads (which vary in their vertical distribution) illustrate the range of heights at which females of this species will oviposit. As a result of its oviposition habits, this species may serve to destroy both feral and domestic populations of *Ae. aegypti*, which are found at various heights. Coincidentally, it should be noted that *Tx. moctezuma* are found in containers located within shaded areas, similar to the localities where *Ae. aegypti* are found (Evans and Bevier (1969).

The collection of *Tx. moctezuma* from containers known to harbor *Ae aegypti* (Chadee 1984) and other mosquito species indicates that a certain degree of natural biological control is occurring in rural communities in Trinidad and Tobago. As a result, *Tx. moctezuma* seems to be a suitable "candidate" species for biocontrol trials by augmentative release in rural and urban situations.

Specimens of *Tx. moctezuma* have been deposited in the Insect Reference Collection at the Caribbean Epidemiology Centre (CAREC). The author wishes to thank Messrs S. B. Ferreira, G. Graham, I. Barrow, N. Mohommed and R. C. Persad for field and laboratory assistance. Special thanks are due to Dr. R. Paul, Specialist Medical Officer (IVCD) and Dr. M. Nicols, County Medical Officer of Health (Tobago) for their assistance. In addition, I thank Dr. E. S. Tikasingh, CAREC and Prof. P. S. Corbet, Department of Biological Science, The University, Dundee, UK for their helpful advice and review of the manuscript.

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NEW JERSEY LIGHT TRAP MODIFICATION TO EXTEND BULB LIFE

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For the past several seasons while using the New Jersey light trap for monitoring of adult mosquito populations, it was noticed that the light bulbs used had a high failure rate. During the 1983 season our commission replaced 32 bulbs in the 12 traps used.

We felt that the best solution to the problem was to convert the traps to operate the bulbs on DC voltage instead of AC. One method of achieving this is to install the little discs that are inserted into the bulb socket and replacing the bulb over the disc. These have been advertised in various magazines and they work quite well. The main objection to these was the price of $2.08 each. For around $0.18 per trap the same conversion can be made.

From an electronic hobby or supply store, buy some axial lead diodes rated at 1000 PIV (peak inverse voltage) at 1 amp. They come in packages of various quantities and prices, usually priced at $0.18 to $0.30 each. There is a band at one end of the diode to determine polarity. In this application it makes no difference which way the diode is installed.

First, disconnect one of the wires attached to the bulb socket and attach one lead of the diode to this point. Then, solder the other lead of the diode to the wire that was just removed. It is advisable to use some type of heat sink while soldering to prevent damage to the diode. Alligator clips or hemostats work fine. Finally, tape the exposed lead to prevent any possible shorts to the light trap body. The diode must be installed in this manner (Fig. 1) and cannot be placed in the main line cord because the fan motor requires AC to run.

With this conversion the bulbs burn dimmer than normal. If 15 or 25 watt bulbs were used before, it is necessary to use 60 watt bulbs to achieve approximately the same illumination. To determine what was happening, the following measurements were made.

With a 15 watt bulb connected directly to 120 volts AC without the diode installed, it would be expected from Ohm's law ($I=P/E=15/120$) that the bulb would draw 0.125 amps. When actually measured, however, the bulb drew 0.108 amps and, by the same formula, this yields 12.9 watts. This is within 20% which is an acceptable tolerance.

With the diode installed, the voltage measured across the bulb was 54 volts DC part of which was caused by the forward resistance of the diode. The measured current in this circuit was 0.056 amps and, again using the above formula, this yields 3 watts. Since the bulb, which was rated at 15 watts was only drawing 3 watts and operating on half of the AC cycle, the brightness was greatly diminished. Hence the reason for using a 60 watt bulb to achieve ap-

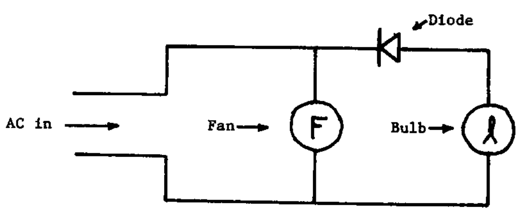

Fig. 1. Schematic diagram showing placement of diode.