AEDES AEGYPTI COLLECTIONS IN RURAL SOUTHEAST TEXAS

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ABSTRACT. A total of 167 specimens of *Aedes aegypti* were collected from rural areas in southeast Texas. Of these, 52 (31.1%) were larvae collected from tree holes with the remainder taken from ovitraps. These collections reconfirm the importance of tree holes as foci and represent atypical breeding sites away from human habitations.

INTRODUCTION

Literature on the ecology of the yellow fever mosquito, *Aedes aegypti* (Linn.), indicates that this species breeds primarily in artificial containers near human habitations (Carpenter and LaCasse 1955, Tinker 1964, von Windeguth et al. 1969, Focks et al. 1981). Additionally, *Ae. aegypti* infestations have been found to be concentrated in the less affluent residential areas of cities (Tinker 1964) due to both the greater number of receptacles present and greater rate of infestation of the receptacles.

Several reports of *Ae. aegypti* breeding in tree holes may be found in the literature. Dunn (1926), Teesdale (1956), Surtees (1960) and Lebrun (1964) have reported on breeding in tree holes in Africa. S. J. Carpenter collected *Ae. aegypti* larvae from tree holes in shade trees near residences in the southern United States (Carpenter and LaCasse 1955). *Aedes aegypti* larvae were frequently found in tree holes during surveys in south Florida (Porter et al. 1961). Christophers (1960) also reported *Ae. aegypti* breeding in tree holes. Recently, Laird and Mokry (1983) described collections of *Ae. aegypti* larvae from papaya trees in the South Pacific.

Collections of *Ae. aegypti* from rural areas in southeast Texas reported herein substantiate the importance of tree holes as foci and also represent atypical breeding sites away from human habitations. These collections were made during studies of tree hole breeding *Aedes* by Sam Houston State University mosquito research students.

MATERIALS AND METHODS

Two sampling techniques were employed to monitor the oviposition by *Aedes* spp. mosquitoes. These techniques were oviposition trapping and larval sampling. Oviposition traps consisted of 12 oz. beer cans with tops removed, lined on the inside with black muslin sleeves for an oviposition surface (Loor and DeFoliart 1969). Nineteen sites for oviposition traps were established approximately 16 km apart from each other along an east-west transect through six counties (Walker, Grimes, Brazos, Burleson, Leon and Madison) in wooded locations where mosquito breeding activity had been identified or suspected (Fig. 1). Four oviposition traps were maintained at each of the sites and serviced weekly during the period June 22, 1977–June 19, 1978. Oviposition trap samples were also collected from site 11 during October and November 1983. During 1977–78 and 1983, oviposition traps were located at ground level. Additional traps were placed 3 m above ground level in 1983. Larval collections were taken from tree holes at sites 4, 6, and 11 when water was present. Total contents of the tree hole were removed with a dipper and/or syringe following Breland (1957).

Samples were transported to the laboratory for processing and identification. Immature stages were reared to the 4th instar and identified. Fourth instar larvae were then reared to the adult stage to confirm identifications.

A vegetation analysis was performed at 3 oviposition trap sites: one within the Austroriparian biotic province (Tharp 1939), one within the Texan biotic province (Tharp 1939), and the other in a transition zone between the two. The purpose of the analysis was to determine the species composition of the stand of trees, the number of trees within the stand, and the number of tree holes occurring within the stand.

Oviposition trap site 1 was selected from the eastern portion of the study area as a representative of the Austroriparian province and site 11 was chosen from the western limit of the study area within the Texan province. Oviposition trap site 6, which was also within the Texan province, was selected because its location appeared to be in a transition zone between the moister Austroriparian and the drier Texan habitats.

A square sample plot, 100 m long on the side, was staked out at each of the three analysis sites. The trees within each 10,000 m^2 sample plot and those trees whose bases occurred more

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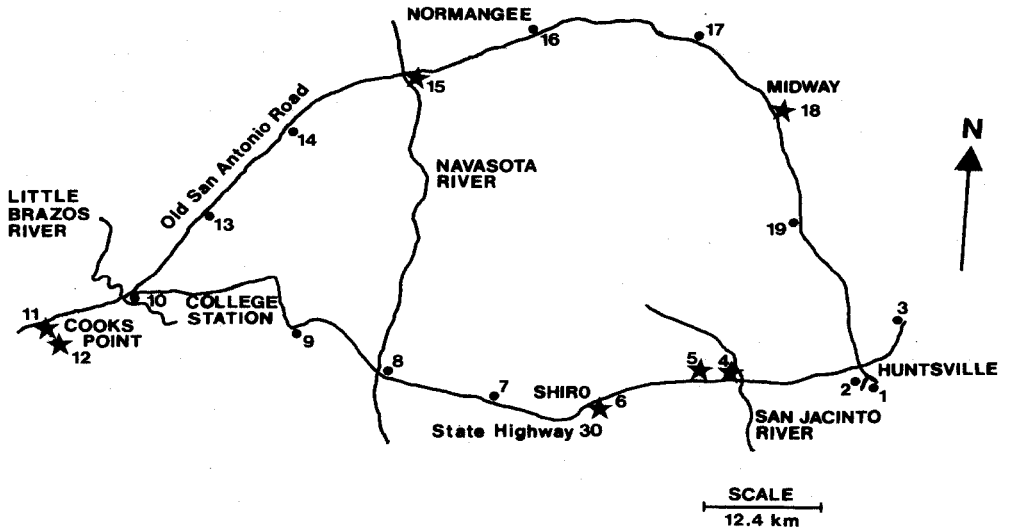

Fig. 1. Location of oviposition trap sites (•) in rural southeast Texas showing those sites positive (★) for *Aedes aegypti*.

than halfway inside the boundary of the plot were identified and counted. An attempt was made to locate and count every tree hole occurring within the sample plot. Ten thousand square meters was chosen for the sample plot size because that was the approximate area of the stand of trees growing at both sites 6 and 11.

RESULTS AND DISCUSSION

One hundred and sixty-seven specimens of *Ae. aegypti* were collected during this study. Of these, 115 (68.9%) were collected from oviposition trap samples and 52 (31.1%) from tree holes (Table 1). During July 1977, oviposition trap sites 12 and 18 were positive for *Ae. aegypti* with 7 and 2 individuals, respectively. Thirteen *Ae. aegypti* were reared from samples collected from site 11 during August 1977. Three locations were positive for *Ae. aegypti* in September 1977; trap sites 5, 6, and 12 with 5, 1, and 15 specimens, respectively. Three locations were positive during October 1977, trap sites 4, 15 and 18 with 4, 10, and 3 specimens, respectively. No further positive samples were collected during the 1977–78 study period after the onset of drought conditions with little or no rainfall. However, oviposition trap samples were collected from site 11 in 1983 resulting in the recovery of 55 *Ae. aegypti* specimens, 5 from ground level and 50 from 3 m above the ground.

Aedes aegypti larvae were collected from tree holes in 3 of the sample areas during 1977. Thirty larvae were recovered from a tree hole in a post oak, *Quercus stellata* Wangenh. within sample site 4 during September 1977. Twenty larvae were collected with larvae of typical tree hole breeding mosquitoes; *Aedes triseriatus* (Say), *Orthopodmyia alba* Baker, and *Orthopodomyia signifera* (Coquillett) from a tree hole in a winged elm, *Ulmus alata* Michx. in site 11 in September. Two *Ae. aegypti* larvae were collected from a hole in *Q. stellata* in association with *Ae. triseriatus, Anopheles barberi* Coquillett, *Or. alba* and *Or. signifera* within sample site 6 during October 1977.

An extensive ground survey was conducted in the vicinity of those sample areas positive for *Aedes aegypti* to locate additional breeding sites. The nearest human habitation to sample site 4 was approximately 3.2 km away. Sample site 11 was located approximately 1.6 km away from the nearest habitation. The distance between sample site 15 and the nearest human habitation was over 8 km. Sample sites 5 and 12 were both located within 100 m of farm houses. Sample site 6 was located in a stand of trees on the grounds of Shiro Red Top Cemetery and site 18 was situated on the west side of Midway Cemetery. Despite intensive surveys of the surrounding areas, no additional sources of *Ae. aegypti* were found near any of the sample sites.

No correlation was observed between presence or absence of *Ae. aegypti* and location, topography or flora. Collections of *Ae. aegypti*

were made in 5 counties, both the Pine-Oak and Oak-Hickory vegetative regions, Austroriparian and Texan biotic provinces, and sites with few to many species of trees present (Table 2). The presence or absence of a human habitation in the vicinity also appeared to be of no consequence.

Results of the vegetation analysis of sample sites 1, 6, and 11 are presented in Table 3. A total of 846 trees occurred within the 10,000 m^2 sample plot at sample site 1. *Liquidambar styraciflua* L. was the only species of tree with tree holes in this plot. Ninety-one tree holes were located giving a relative frequency of 0.1 tree hole per tree (0.4 for *L. styraciflua*). The sample plot at site 6 included the fewest number of trees of the 3 locations. One hundred and two trees and 16 tree holes were counted. All of the tree holes occurred in *Q. stellata*, giving a relative frequency of 0.2 tree hole per tree and 0.6 tree hole per *Q. stellata*. The vegetation analysis plot at sample site 11

Table 1. Comparison of total number of immature *Aedes aegypti* collected from oviposition traps and tree holes at sampling sites in rural southeast Texas to rainfall and temperature recorded in the vicinity (College Station, TX).

	Number of immature *Ae. aegypti* collected													
	1977						1978						1983	
Sampling Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Oct/Nov	Total
4	0	0	30*	4	0	0	0	0	0	0	0	0	—	34
5	0	0	5	0	0	0	0	0	0	0	0	0	—	5
6	0	0	1	2*	0	0	0	0	0	0	0	0	—	3
11	0	13	20*	0	0	0	0	0	0	0	0	0	55	88
12	7	0	15	0	0	0	0	0	0	0	0	0	—	22
15	0	0	0	10	0	0	0	0	0	0	0	0	—	10
18	2	0	0	3	0	0	0	0	0	0	0	0	—	5
Total	9	13	71	19	0	0	0	0	0	0	0	0	55	167
Rainfall (mm)	1.5	40.6	44.5	45.7	69.1	53.8	94.7	71.6	64.5	52.6	57.9	61.7	—	658.2
Mean Temp. (°C)	29.2	29.8	27.7	21.9	16.7	11.7	4.7	7.3	14.5	20.9	25.4	28.2	—	19.8

* Sample collected from tree hole.
— No sample collected.

Table 2. Occurrence of *Aedes aegypti* larvae at sites in rural southeast Texas.

Sample site	*Ae. aegypti*	County	Vegetative region[1]	Biotic province[2]	Dominant trees[3]
1	—	Walker	Pine-Oak	Aus	BG,SG,P,WO
2	—	Walker	Pine-Oak	Aus	SG,P
3	—	Walker	Pine-Oak	Aus	SG,P
4	+	Walker	Pine-Oak	Aus	PE
5	+	Walker	Pine-Oak	Aus	WE,PO
6	+	Grimes	Oak-Hickory	Tex	C,PO,WO,WE
7	−	Grimes	Oak-Hickory	Tex	P,RO,BO,PO
8	−	Grimes	Oak-Hickory	Tex	WO,PO,WE
9	−	Brazos	Oak-Hickory	Tex	PO,LO,WE
10	−	Brazos	Oak-Hickory	Tex	PO,LO,WE,H
11	+	Burleson	Oak-Hickory	Tex	WE,LO
12	+	Burleson	Oak-Hickory	Tex	WE,LO,BD
13	−	Brazos	Oak-Hickory	Tex	WE,H
14	−	Brazos	Oak-Hickory	Tex	LO.WE
15	+	Leon	Oak-Hickory	Tex	WO,WE,H
16	−	Leon	Oak-Hickory	Tex	WE
17	−	Madison	Oak-Hickory	Tex	WO,PO,WE
18	+	Madison	Pine-Oak	Aus	PO
19	−	Walker	Pine-Oak	Aus	P,WE,SG

[1] Blair (1950).
[2] Tharp (1939).
[3] BD = Bois-d'arc, *Maclura pomifera* (Raf.); BG = Black Gum, *Nyssa sylvatica* Marsh.; BO = Blackjack Oak, *Quercus marilandica* Muench.; C = Eastern Red Cedar, *Juniperus virginiana* L.; H = Hackberry, *Celtis occidentalis* L.; P = Loblolly pine, *Pinus taeda* L.; PE = Pecan, *Carya illinoensis* (Wangenh) K.; PO = Post Oak, *Quercus stellata* Wangenh; RO = Southern Red Oak, *Quercus falcata* Michx.; SG = Sweetgum, *Liquidambar styraciflua* L.; WE = Winged Elm, *Ulmus alata* Michx.; and WE = Water Oak, *Quercus nigra* L.

Table 3. Tree species composition and tree hole characteristics of 3 sample sites in rural southeast Texas.

Sample site number	Tree species	Number of trees	Frequency of trees	Frequency of tree holes
1	Black Gum, *Nyssa sylvatica* Marsh.	226	26.7	0.0
	Sweetgum, *Liquidambar styraciflua* L.	222	26.2	0.4
	Loblolly Pine, *Pinus taeda* L.	157	18.6	0.0
	Water Oak, *Quercus nigra* L.	68	8.0	0.0
	Winged Elm, *Ulmus alata* Michx.	60	7.1	0.0
	Southern Red Oak, *Quercus falcata* Michx.	56	6.6	0.0
	Flowering Dogwood, *Cornus florida* L.	16	1.9	0.0
	Yaupon, *Ilex vomitoria* Ait.	14	16	0.0
	Rusty Blackhaw, *Viburnum rufidulum* Raf.	11	1.3	0.0
	Post Oak, *Quercus stellata* Wangenh.	6	0.7	0.0
	American Holly, *Ilex opaca* Ait.	5	0.6	0.0
	Red Maple, *Acer rubum* L.	5	0.6	0.0
6	Eastern Red Cedar, *Juniperus virginiana* L.	53	52.0	0.0
	Post Oak, *Q. stellata*	26	25.5	0.6
	Water Oak, *Q. nigra*	17	16.7	0.0
	Winged Elm, *U. alata*	6	5.9	0.0
11	Winged Elm, *U. alata*	154	97.5	2.2
	Live Oak, *Quercus virginiana* Mill.	4	2.5	0.0

had 158 trees with a total of 344 tree holes observed. Tree holes were only observed in *U. alata,* resulting in a relative frequency of 2.2 tree holes per tree.

Collections made during this study resulted in new records of *Ae. aegypti* for 2 counties. *Aedes aegypti* was previously unreported from Madison and Walker counties (Fournier and Snyder 1977). Samples from site 18 in Madison County, and sites 4 and 5 in Walker County were positive for this species during 1977.

The recovery of *Ae. aegypti* from tree holes and oviposition traps from 5 counties in rural southeast Texas corroborates earlier findings that *Ae. aegypti* breeding is not limited to artificial containers and demonstrates that breeding is not restricted to the urban environment. In addition, collections of *Ae. aegypti* from one of these sites in 1977 and later in 1983 suggest that this species is well established at least in this location. Therefore, it is recommended that rural areas should not be overlooked during surveys and control activities for *Ae. aegypti.*

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