ARTICLES

INVASION OF CEMETERIES IN FLORIDA BY *AEDES ALBOPICTUS*

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ABSTRACT. *Aedes albopictus* has been found in 53 of the 67 Florida counties. The initial discoveries in 11 of these counties were made in cemeteries. At several locations, *Ae. albopictus* became well-established in cemeteries before appearing in nearby accumulations of waste tires. The recycling of plastic floral baskets may be aiding the spread of *Ae. albopictus*. Mosquitoes were commonly found in all types of flower-holding containers in cemeteries, except bronze vases. In the laboratory, most *Aedes aegypti* eggs laid in bronze vases hatched, but larvae subsequently died. The spread of *Ae. albopictus* in cemeteries seems to occur at the expense of *Ae. aegypti* populations. At one cemetery immature *Ae. albopictus* and *Ae. aegypti* were found in about 70% of the *Aedes*-positive containers at the start of a monitoring program. In subsequent collections from this site, *Ae. albopictus* was found in nearly all *Aedes*-positive containers, whereas there was a progressive decrease in containers with *Ae. aegypti*. This trend did not appear to be the result of any seasonal pattern because in a nearby cemetery where *Ae. albopictus* was absent, *Ae. aegypti* did not show a similar decline. Limiting flower-holding containers to those with drain holes or to bronze vases would greatly limit mosquito production.

INTRODUCTION

In 1986, *Aedes albopictus* (Skuse) was initially discovered in Florida at a waste tire site in Jacksonville (Peacock et al. 1988). By the end of 1989 this exotic mosquito had been found in 11 of the 67 Florida counties (Smith et al. 1990), and during 1990 it was detected in 40 more counties. In several of these counties the initial discovery was made from cemeteries.

The varied types of micro- and macrohabitats found within and among cemeteries make them ideal locations for investigating the environmental factors that influence the distribution and abundance of resident and exotic container-inhabiting mosquitoes (Schultz 1989). The relative stability of mosquito habitats in cemeteries makes it possible to follow changes in species composition over time and to compare these populations with those found in adjacent areas. At least one type of flower-holding container that is common in many Florida cemeteries is normally recycled and, thus, may provide a mechanism for spreading exotic *Aedes* from one cemetery to another.

This report examines the role cemeteries play in harboring and spreading populations of *Ae. albopictus*. The specific objectives of the studies were: 1) to improve our understanding of the distribution of *Ae. albopictus* in Florida, particularly with regard to cemetery sites; 2) to evaluate the effects of cemetery regulations and maintenance practices on populations of container-inhabiting mosquitoes; 3) to compare the relative abundance of resident and exotic *Aedes* in specific micro- and macrohabitats within cemeteries and to monitor changes in the species over time; and 4) to ascertain how cemeteries may be invaded by *Ae. albopictus*.

MATERIALS AND METHODS

Survey for Ae. albopictus in Florida: During 1990, *Ae. albopictus* was sampled for in 46 Florida counties. The search was initially focused near counties known to have populations of this species. Collections were made at tire and auto repair shops, county landfills, illegal tire piles and cemeteries. Greater emphasis was placed on sampling in cemeteries after finding *Ae. albopictus* in several cemeteries but not in nearby accumulations of waste tires. Mosquitoes were principally identified in the laboratory as immatures, but blood-seeking females were also identified in the field.

Monitoring populations of immature Aedes in cemeteries: Four north Florida cemeteries: Evergreen (Jacksonville), Evergreen (Gainesville), Oak Hill (Palatka) and Shady Rest (Holly Hill) were sampled on ca. 7 wk intervals from late spring or early summer in 1990 until February 1991. From the containers holding water in these 4 cemeteries, the following information was collected: type of container, water volume, presence or absence of mosquitoes, species composition, name on grave site, and the amount of shade. Results of preliminary sampling indicated that bronze vases (a type of flower-holding container common in some Florida cemeteries) seldom

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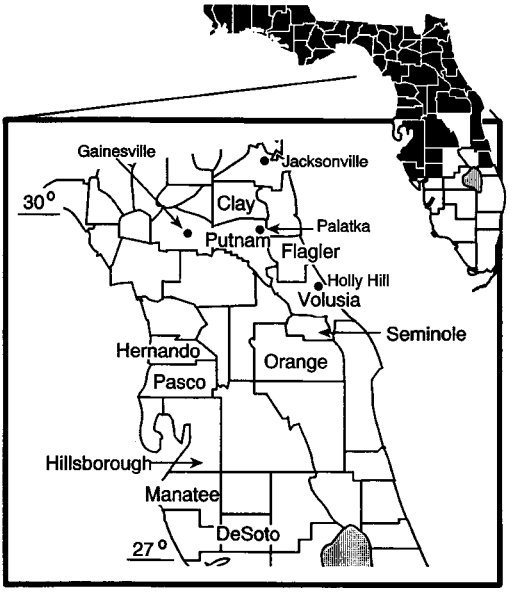

Fig. 1. Distribution of *Aedes albopictus* in Florida as of June 1991 is shown on the outline map. In the 53 shaded counties, *Ae. albopictus* has been found at one or more sites. The locations of the 11 counties in which *Ae. albopictus* was initially detected in a cemetery and the 4 cities where cemeteries were monitored most frequently for container-inhabiting mosquitoes are indicated on the enlarged portion of the Florida map.

contained immature *Aedes*. Therefore, bronze containers were not included in the regular monitoring of the 4 cemeteries mentioned above.

Studies with bronze vases: Laboratory experiments were conducted to compare the effects of container types on oviposition and larval development. For the larval development experiment, thirty 1st instar *Ae. aegypti* and 350 ml of drinking water were added to each of 3 plastic cups and 3 bronze vases. All 6 containers were provided equivalent amounts of liver powder and were maintained in a room with a temperature of 26.5 ± 1.0°C, a RH of 85 ± 10%, and a daily photoperiod of 15L:9D. The development of the larvae was observed over an 8 day period. In another experiment, 3 cages (each 30 × 30 × 30 cm) were stocked with 25 blood-fed *Ae. aegypti* females. Each cage contained a plastic cup lined with paper toweling and a bronze vase. The number of eggs laid in each container was recorded and then the eggs were flooded with deoxygenated water to determine the percent hatch.

On 6 occasions between July 1990 and February 1991, 16 to 32 water-holding bronze vases in the Evergreen Cemetery (Jacksonville) were sampled for immature mosquitoes. On each collection date samples were taken from both shaded and unshaded bronze vases and from a variety of other types of flower-holding containers. Bronze vases were also examined for mosquitoes in cemeteries in Alachua (2), Brevard (1), Putnam (1), St. Lucie (1) and Volusia (1) counties.

RESULTS AND DISCUSSION

During 1990 the number of Florida counties known to be positive for *Ae. albopictus* increased from 11 to 51. Twenty-nine of these new county records were established by the survey conducted in the present study. Two more new county records for *Ae. albopictus* have been added in 1991. In 11 Florida counties, the initial discovery of *Ae. albopictus* was made at cemetery sites (Fig. 1). Between May 1990 and February 1991, immature *Aedes* were collected from 51 of 68 Florida cemeteries sampled and *Ae. albopictus* was detected in 22 of these. Currently, cemetery populations of *Ae. albopictus* are very common throughout much of north Florida, widely but sparsely distributed in the central part of the state, and absent or rare in south Florida (Table 1).

Some types of cemeteries are more likely to harbor container-inhabiting mosquitoes than others. Many newer cemeteries, especially those that are operated by private companies, produce few, if any, mosquitoes because most of the grave sites are not shaded by trees or shrubs and the predominant container type is the bronze vase (Fig. 2a). However, older cemeteries, particularly ones that are well-shaded and have a variety of container types, normally have some grave sites with containers positive for immature *Aedes*. The use of a sprinkler system for watering the shrubs and lawn and the common occurrence of immovable containers (e.g., large marble vases that are cemented or glued to the gravestone) may further increase the likelihood of mosquito production, especially if these containers lack drain holes (Fig. 2b).

Artificial ("silk") flowers were more common than fresh-cut flowers in cemetery containers. Water accumulates unnecessarily in most of the containers with silk flowers due to a lack of a drain hole. The dense shaded cover, provided by most silk flower arrangements, enhances the container's water retention capacity, while it apparently inhibits oviposition by the predatory mosquito, *Toxorhynchites rutilus* (Coq.). Even in tree-shaded cemeteries, *Tx. rutilus* larvae were seldom collected from containers with silk flower arrangements.

The prevalence of bronze containers varied considerably among cemeteries. In 6 of 7 ceme-

Table 1. Prevalence of immature *Aedes albopictus* in *Aedes*-positive Florida cemeteries sampled between May 1990 and February 1991.

Region of Florida	No. counties sampled	No. cemeteries sampled	No. cemeteries with *Aedes albopictus*
North	6	8	7
Central	15	32	15
South	6	11	0
Total	27	51	22

teries where bronze vases were sampled, all of the water samples from bronze vases were negative for mosquitoes, while at least some of the non-bronze containers were positive for *Aedes* (Table 2). On only 2 of 6 collecting dates were immature *Aedes* found in bronze vases in the Evergreen Cemetery (Jacksonville). By contrast, at this cemetery immature *Aedes*, primarily *Ae. albopictus*, were collected from non-bronze containers on all 6 collecting dates (Table 2). Overall, in the Evergreen Cemetery (Jacksonville) only 6.3% of the bronze containers (9/144) were positive for mosquitoes, whereas 54.4% of the non-bronze containers (123/226) were positive.

Under our laboratory conditions, gravid *Ae. aegypti* females readily oviposited in bronze vases. The percent hatch of these eggs was very high, and in 2 out of 3 trials it was equivalent to the levels found in eggs laid in plastic cups lined with paper toweling (Table 3). These observations suggest that the paucity of immature *Aedes* in bronze vases is not due to an oviposition deterrent or reduced hatchability of eggs laid on bronze.

In the laboratory test on *Aedes aegypti* larval development, 88 of the 90 individuals in the 3 plastic cups completed development to the adult stage, while none of the 90 larvae in the 3 bronze vases survived beyond the 2nd instar. Most larvae in bronze vases died within 3 days posthatch and all were dead after 7 days. Based on these findings, the major factor limiting mosquito production from bronze vases in the field may be the excessive larval mortality caused by the inhibition of larval development. However, on a few occasions late instars and pupae of *Ae. albopictus* were collected from bronze vases in the Evergreen Cemetery (Jacksonville). Clearly, additional studies are needed to identify: 1) the specific mechanisms responsible for the larvicidal properties of bronze vases, and 2) the conditions under which mosquitoes may develop in this type of flower-holding, cemetery container. We suspect that copper, a main component of bronze vases, is the primary factor responsible for preventing mosquito development in these vases. Various copper compounds are used as fungicides and algicides (Ware 1989). At least one proprietor of a used tire storage facility in Florida is using copper sulfate as a mosquito larvicide with great success.

By the middle of 1989, *Ae. albopictus* populations were common in Gainesville and Jacksonville (Smith et al. 1990, Moore et al. 1990, K. Etherson, unpublished data). Therefore, it was not surprising that this mosquito would be well-established in the Evergreen cemeteries in these 2 cities when our sampling program began in 1990. From collections taken at the Evergreen Cemetery in Jacksonville between July 1990 and February 1991, all but 2 of the 134 *Aedes*-positive samples contained *Ae. albopictus*. By contrast, immature *Ae. aegypti* were detected in only 5 samples and *Aedes triseriatus* (Say) in only 2 samples. On each collection date ($n = 5$) the frequency of *Ae. aegypti* or *Ae. triseriatus* samples did not exceed 10%. A similar pattern was noted from 6 collections made at the Evergreen Cemetery in Gainesville between June 1990 and March 1991. Overall, 125 of the 139 *Aedes*-positive samples (89.9%) contained *Ae. albopictus*, whereas only 4 samples (2.9%) had *Ae. aegypti*. On the other hand, *Ae. triseriatus* is common in this cemetery. It was found in 63 of the *Aedes*-positive samples (45.3%).

By monitoring populations of container-inhabiting *Aedes* in north Florida cemeteries, major changes in species composition were documented. In June 1990, immatures of both *Ae. albopictus* and *Ae. aegypti* were found in nearly 70% of the *Aedes*-positive, flower-holding containers in the Oak Hill Cemetery (Palatka) in Putnam County. In 6 collections taken over a 9-month period, *Ae. albopictus* became dominant as *Ae. aegypti*-positive containers decreased (Fig. 3). This trend does not appear to be the result of any seasonal pattern because, in the Shady Rest Cemetery (Holly Hill) in neighboring Volusia County, the *Ae. aegypti* population did not decline during the same period (Fig. 4). It was present in all of the 66 *Aedes*-positive samples taken over a 7 month period. *Aedes albopictus* was recovered from only one container and that was on the last sampling date. Similarly, only one sample was found to contain *Ae. triseriatus*. The frequency of *Aedes*-positive containers had similar seasonal patterns at both the Oak Hill and Shady Rest cemeteries (Fig.

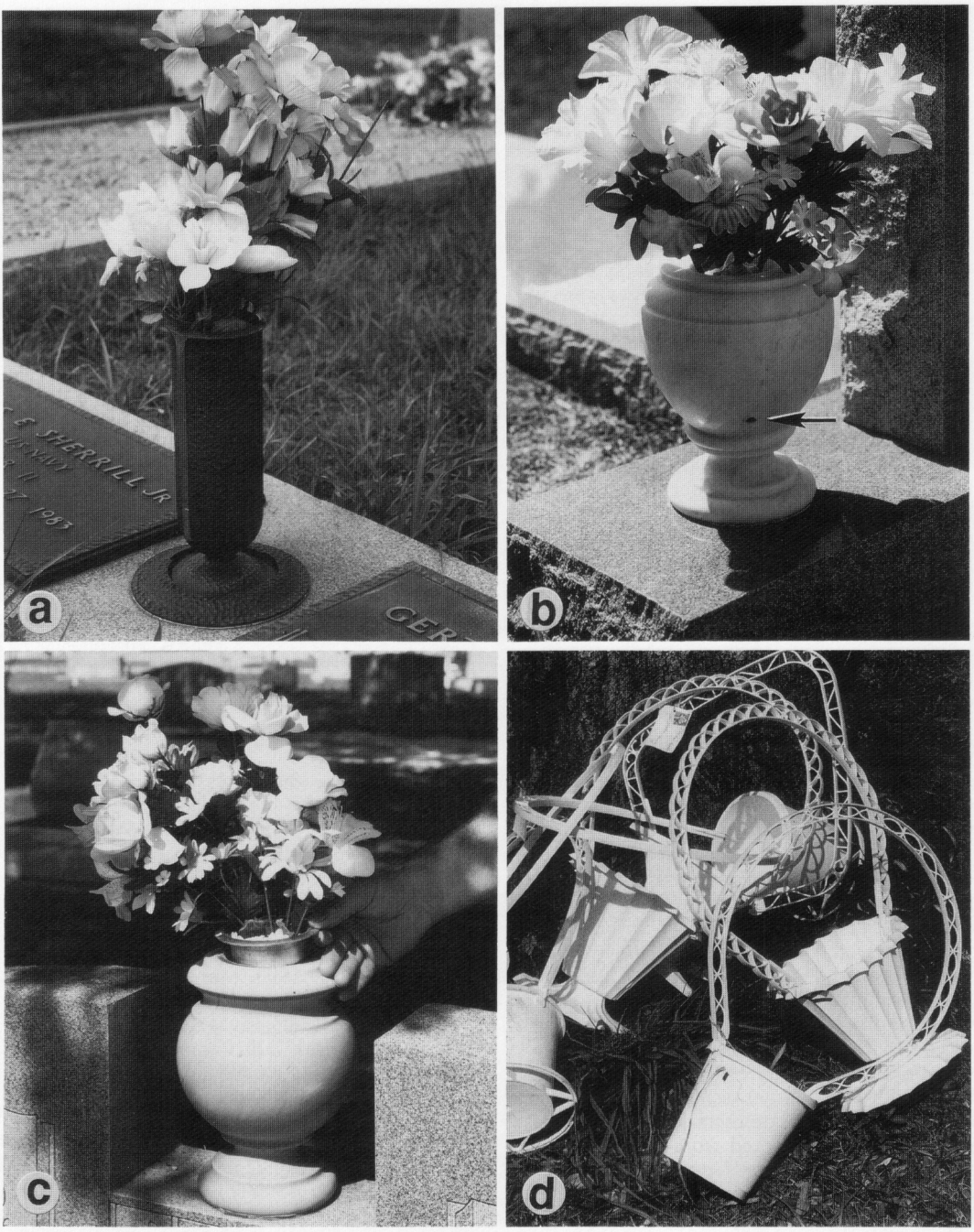

Fig. 2. Types of containers found in Florida cemeteries: a) a bronze vase, b) a stone vase with a drain hole, c) a stone vase with a metal insert, and d) used plastic floral baskets being stored outdoors.

Table 2. Occurrence of immature *Aedes* in bronze vases and other types of flower-holding containers in Florida cemeteries.

Date	Bronze vases[1]		Other containers[1]	
	No. sampled	Percent positive	No. sampled	Percent positive
	Evergreen Cemetery, Jacksonville			
Jul. 11, 1990	16	0.0	28	57.1
Jul. 18, 1990	16	0.0	24	45.8
Sep. 9, 1990	20	0.0	45	82.2
Oct. 24, 1990	30	23.3	43	79.1
Dec. 12, 1990	30	0.0	47	25.5
Jan. 29, 1991	32	6.3	39	33.3
	Evergreen Cemetery,[2] Gainesville			
Jul. 24, 1990	1	0.0	33	81.8
Sep. 11, 1990	2	0.0	43	83.7
Oct. 30, 1990	2	0.0	45	77.8
Dec. 20, 1990	1	0.0	27	48.1
	Oak Hill Cemetery,[2] Palatka			
Jul. 25, 1990	2	0.0	33	54.5
Feb. 7, 1991	2	0.0	41	46.3
	Forest Meadow Memorial Gardens,[3] Gainesville			
Jun. 4, 1990	32	0.0	NA	NA
Nov. 5, 1990	25	0.0	NA	NA
	Oaklawn Memorial Gardens, Titusville			
Oct. 22, 1990	38	0.0	38	18.4
	Hillcrest Memorial Gardens,[3] Ft. Pierce			
Jun. 7, 1990	30	0.0	NA	NA
	Shady Rest Cemetery,[2] Holly Hill			
Feb. 12, 1991	5	0.0	39	17.9
Totals	284	3.2	525	54.3

[1] Only containers with water were sampled.
[2] Bronze vases are uncommon in these cemeteries.
[3] All containers in these cemeteries are bronze vases.

4), although the 2 sites differed in terms of the dominant mosquito species. Overall, *Aedes* mosquitoes were found in 50.4% of the samples from the Shady Rest Cemetery and 57.8% of those from the Oak Hill Cemetery. Among the *Aedes*-positive samples, no significant difference was observed in the mean number of immature mosquitoes per ml of water between the 2 sites (mean ± SD = 0.16 ± 0.26 [Shady Rest] vs. 0.11 ± 0.16 [Oak Hill]; $t = 1.25$, df = 153, $P > 0.05$). These results suggest that in some cemeteries the spread of *Ae. albopictus* is occurring at the expense of resident *Ae. aegypti* populations.

The spread of *Ae. albopictus* in parts of Texas and Louisiana has been associated with a decline in the abundance of *Ae. aegypti* (Hawley 1988, Nasci et al. 1989). To what extent the decline in *Ae. aegypti* has been caused by the expansion of *Ae. albopictus* populations is unknown. Additional field studies in the southeastern United States are needed to document more clearly the types of habitats in which populations of *Ae. aegypti* are undergoing decline and to assess the role *Ae. albopictus* populations may play in bringing about these changes. Laboratory tests designed to evaluate larval competition between *Ae. aegypti* or *Ae. triseriatus* and *Ae. albopictus* may have little relevance to what is happening under field conditions (Black et al. 1989, Ho et al. 1989). Many other types of interactions may also occur between native, resident and exotic *Aedes*. For example, Nasci et al. (1989) suggest that the adverse reproductive effects of interspecific mating on female *Ae. aegypti* may be one of the important factors responsible for the displacement of *Ae. aegypti* since the introduction of *Ae. albopictus* into the southeastern United States.

In several Florida counties, *Ae. albopictus* was well-established in cemeteries before it became common in nearby sites with scrap tires. For example, before 1990, mosquito collections taken by the Putnam County Mosquito Control Unit (MCU) were negative for *Ae. albopictus*. With the assistance of the Putnam County MCU, we sampled for immature *Aedes* at several locations in the late spring and in mid-summer, 1990. In the spring, *Ae. albopictus* was detected at 3 of 4 cemeteries, whereas it was found at only one of 11 scrap tire sites. The scrap tire site that contained *Ae. albopictus* was not located near any of the cemeteries. Although *Ae. albopictus* was found in the Oak Hill Cemetery in the city of Palatka, only *Ae. aegypti* was collected at nearby locations with accumulations of used tires. However, later in the summer, most of the scrap tire sites (7/11) were positive for *Ae. albopictus*.

Southeast of Palatka in neighboring Flagler and Volusia counties, immature *Ae. albopictus* were collected from flower-holding containers in rural cemeteries, but this mosquito was not found in used tires in urban or commercial zones located just a few kilometers away from these cemeteries (Table 4). Immature *Ae. albopictus* were found in both cemeteries and tire piles in the Brooksville area of Hernando County. Here, the sampling effort involved 2 cemeteries (one suburban and one rural) and 4 tire stores or auto repair shops with accumulations of used tires. *Aedes albopictus* was common in both cemeteries, while *Ae. aegypti* was rare or absent. However, at the sites with used tires, *Ae. aegypti* was the dominant species (Table 4). In fact, *Ae. albopictus* was not detected in the 2 used tire sites that were nearest to the suburban cemetery (i.e., within 0.5 km). *Aedes albopictus* was also

Table 3. Effects of container type on *Aedes aegypti* oviposition and egg hatch.[1]

Replicate	Type of container[2]	Eggs			P
		No. laid	No. hatched	% hatched	
1	Plastic cup	886	782	88.3	>0.05
	Bronze vase	634	549	86.6	
2	Plastic cup	589	573	97.3	<0.05
	Bronze vase	629	587	93.3	
3	Plastic cup	1,373	1,310	95.4	>0.05
	Bronze vase	969	924	95.4	

[1] Each cage contained 25 blood-fed *Ae. aegypti* females.
[2] Interior of plastic cup was lined with paper toweling.

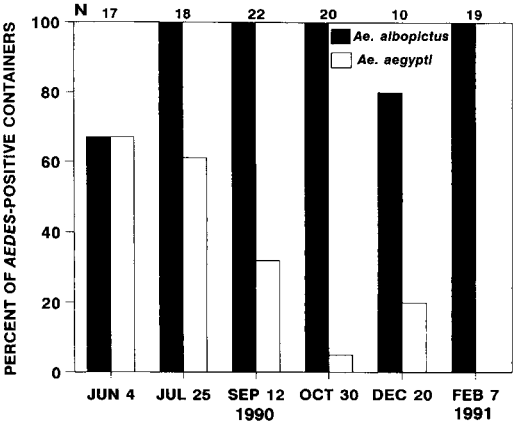

Fig. 3. Occurrence of immature *Aedes aegypti* and *Ae. albopictus* in *Aedes*-positive containers at the Oak Hill Cemetery in Putnam County (Palatka), Florida.

collected from the Joshua Creek Cemetery in De Soto County, while only *Ae. aegypti* was collected in scrap tires at nearby sites. Similar results were also obtained in Seminole County (Table 4).

Thus, based on results obtained in 6 counties (De Soto, Flagler, Hernando, Putnam, Seminole and Volusia), it appears that *Ae. albopictus* populations are becoming well-established in cemeteries more rapidly than they are in accumulations of tires. Plastic floral baskets with fresh-cut flowers are often placed at a grave site at the time of burial. After a few days the wilted flowers are discarded, but usually the baskets are recycled. They may return to the same or to a different cemetery holding either fresh or "silk" flowers. *Aedes* eggs laid while the basket is in one cemetery may hatch in another. This invasion route may explain why *Ae. albopictus* has become established in some cemeteries before appearing in nearby waste tire sites.

Schultz (1989) found *Ae. albopictus* and *Ae. aegypti* in cement vases in cemeteries in Manila, Republic of the Philippines, with *Ae. albopictus* being the dominant *Aedes* in shaded cemeteries containing plant debris in the flower-holding vases. Yet in Manila, *Ae. albopictus* seldom invaded nearby residential areas where *Ae. aegypti* was typically the dominant container-inhabiting *Aedes*. At lower latitudes in parts of tropical and subtropical Asia, *Ae. aegypti* populations usually dominate the urban areas, while *Ae. albopictus* is normally more abundant in rural and sylvan areas (Chan et al. 1971, 1989). As *Ae. albopictus* has spread across north Florida it has invaded urban, suburban, rural and sylvan areas, and at many locations it has rapidly become the dominant container-inhabiting *Aedes*. The spread of *Ae. albopictus* southward through the Florida peninsula has been occurring much slower. Yet, further expansion southward is expected, and as this process continues, cemeteries will likely be prime locations for the establishment of new *Ae. albopictus* populations in subtropical Florida.

At 3 cemeteries the amount of shade provided by trees and shrubs was characterized into 3 general categories (full, partial and none). Although many of the flower-holding containers in the Evergreen (Jacksonville and Gainesville) and Oak Hill (Palatka) cemeteries were heavily shaded by trees and shrubs, some containers were in more open areas and subjected to direct sunlight for at least part of the day. Within each cemetery, the frequency of water-holding containers positive for immature *Ae. albopictus* was approximately 50% or greater for each shade category. The frequency of containers with *Ae. albopictus* was not significantly different among the shade categories when the result from the 3 cemeteries were combined (Table 5). Also, a comparison of the mean number of *Ae. albopictus* immatures per wet container among the 3 shade categories yielded no significant differences (Table 6). However, wet containers are usually more common in partially or fully shaded microhabitats than they are in unshaded ones.

Aedes triseriatus was often a common and sometimes the dominant mosquito in the

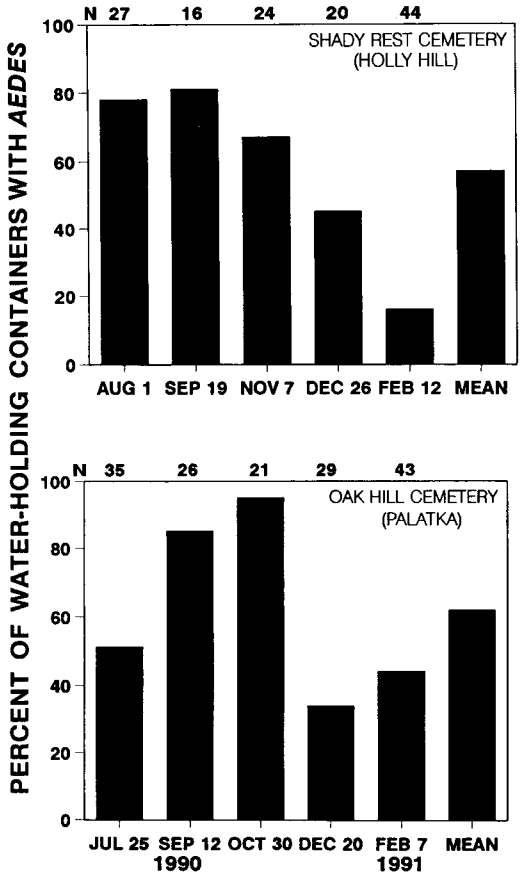

Fig. 4. Comparison of the prevalence of water-holding containers with *Aedes* mosquitoes in 2 north Florida cemeteries.

aquatic habitats provided by the flower-holding containers in heavily shaded rural and suburban cemeteries, especially those that were along the leading edge of the expanding southern limit of *Ae. albopictus* (Table 4). Immatures of *Ae. triseriatus* and *Ae. albopictus* were collected from tree holes in the Evergreen cemeteries (Jacksonville and Gainesville), but only at the Gainesville location was *Ae. triseriatus* common in the flower-holding containers. Nevertheless, both cemeteries are very similar in terms of the availability of tree-shaded habitats and the diversity of flower-holding containers. Periodic sampling of the containers in these 2 cemeteries will continue to determine whether there are any long-term changes in the relative abundance of *Ae. triseriatus*. Unfortunately, when monitoring of the container-inhabiting mosquitoes was begun in the Evergreen cemeteries, *Ae. albopictus* was already well-established. Hence, we could not assess the effects of the *Ae. albopictus* invasion on resident *Ae. triseriatus* populations. Initial collections from artificial containers in several central and south Florida cemeteries indicated that *Ae. triseriatus* was common, while *Ae. albopictus* was less common or absent. By continuing to monitor the relative abundance of immature mosquitoes at these cemeteries, it should be possible to determine if expansion of *Ae. albopictus* populations is associated with a decline of not only *Ae. aegypti* but also *Ae. triseriatus*. Based on field studies using surrogate tree holes (black jars), Schreiber et al. (1988) concluded that the coexistence of *Ae. albopictus* and *Ae. triseriatus* in these habitats was mediated by the predator, *Toxorhynchites rutilus septentrionalis* (Dyar and Knab). Since this predator is rarely found in flower-holding containers in Florida cemeteries, it will likely remain an insignificant factor in the regulation of community structure in these artificial containers.

Several simple steps can be taken to limit mosquito production from cemeteries. In Florida, the flower-holding containers that remain in cemeteries for extended periods generally have artificial flower arrangements. Obviously, there is no need for these containers to hold water. The accumulation of water could be prevented by using only containers with drain holes. Thus, we recommend that all containers with "silk" flowers have at least one drain hole. Presently, among the various types of cemetery containers being used in Florida cemeteries, only stone or concrete ones normally have drain holes. These holes may occasionally become plugged with leaf litter or plastic packing materials used to keep the artificial flowers in place, but it is usually a simple task to correct this problem. For containers lacking drain holes other approaches may be used to eliminate the mosquito's aquatic habitat. For example, the container could be filled with sand in which the "silk" flowers could be anchored. Some "silk" flowers are attached to a styrofoam base that fills the entire surface area of the container. As long as the base remains snugly in place, mosquitoes are denied access to these containers. Still, the best approach is to place "silk" flowers in the ground or to attach them to the gravestone without using any type of container.

The use of plastic or metal inserts can help to reduce mosquito production, especially in immovable containers which lack drain holes and are normally used to hold fresh-cut flowers (Fig. 2c). These inserts are most commonly found in the circular holes (usually ca. 10 cm diam) that have been placed in the gravestones for holding flowers. Bronze inserts seem most effective because, like the bronze vases, there is usually no mosquito production. Even the use of less ex-

Table 4. *Aedes* mosquitoes collected at scrap tire and cemetery sites in 5 Florida counties during 1990 and 1991.

County Type of site and location	No. *Aedes* positive containers sampled	No. of containers with immature		
		Aedes aegypti	*Aedes albopictus*	*Aedes triseriatus*
Flagler				
Cemeteries				
Espanola	53	0	36	27
Korona	1	0	0	1
Scrap tires				
Bunnell				
Site 1	17	17	0	0
Site 2	6	6	0	0
Volusia				
Cemeteries				
Seville	21	4	16	11
Pierson				
Site 1	9	7	2	0
Site 2	1	0	1	0
Site 3	16	12	12	5
Scrap tires				
Barberville	6	6	0	0
Deland	1	1	0	0
Hernando				
Cemeteries				
Lake Lindsey	8	0	4	8
Brooksville	21	1	7	14
Scrap tires				
Brooksville				
Site 1	5	5	0	0
Site 2	6	5	2	0
Site 3	4	3	2	0
Site 4	6	6	0	0
DeSoto				
Cemeteries				
Arcadia/Nocatee				
Site 1	41	26	4	27
Site 2	18	18	0	0
Scrap tires				
Arcadia/Nocatee				
Site 1	7	7	0	0
Site 2	1	1	0	0
Site 3	6	6	0	0
Site 4	7	7	0	0
Site 5	5	5	0	0
Site 6	5	5	0	0
Seminole				
Cemetery				
Lake Mary	40	19	34	3
Scrap tires				
Sanford				
Site 1	2	2	0	0
Site 2	1	1	0	0
Site 3	2	2	0	0
Site 4	7	7	0	0
Site 5	3	3	0	0
Site 6	6	6	0	0
Site 7	4	4	0	0
Site 8	5	5	0	0

Table 5. Effects of shade on the occurrence of immature *Aedes albopictus* in water-holding containers[1] in cemeteries.

Shade	Frequency of *Aedes albopictus* positive containers							
	n	% positive	*n*	% positive	*n*	% positive	*n*	% positive[2]
Cemeteries[3]	Evergreen (JAX)		Evergreen (GNV)		Oak Hill (PAL)		Totals	
Full	81	56.8	68	67.6	66	69.7	215	64.2
Intermediate	82	54.9	61	75.4	48	43.8	191	58.6
None	63	49.2	34	52.9	36	55.6	133	51.9

[1] Bronze containers excluded.
[2] Tukey's multiple range test (SAS Institute 1985) indicated no significant differences ($P > 0.05$).
[3] Data shown for each cemetery represents the combined results from 5 sample dates.

Table 6. Abundance of immature *Aedes albopictus* in flower-holding containers in 3 north Florida cemeteries.[1]

Shade	Containers with immature *Ae. albopictus*	
	No. sampled	Immatures/container (Mean ± SE)[2]
Full	144	30.3 ± 3.6
Intermediate	115	29.8 ± 3.2
None	69	32.0 ± 4.4

[1] Evergreen (Jacksonville), Evergreen (Gainesville) and Oak Hill (Palatka). Samples taken on 5 collection dates from each cemetery.
[2] One-way ANOVA, $F = 0.07$, $P > 0.05$.

pensive inserts can greatly assist mosquito control efforts. A water-tight insert with a collar that fits flush against the lip of the container will limit mosquito production to just the insert. If an immovable container is equipped with such an insert, then the nutrient-rich water along with any immature mosquitoes can be easily discarded simply by removing the insert and dumping out the contents.

A major influx of fresh-cut flower bouquets occurs in some cemeteries around special dates, such as Mother's Day (Barrera-Rodriguez et al. 1982). By the time wilted flowers are usually removed from grave sites a considerable amount of organic matter has already been added to the water in the flower holding containers, and such a condition will tend to enhance mosquito production (Barrera-Rodriguez et al. 1979). In the one cemetery where we found fresh-cut flowers much more common than "silk" flowers, most of the bouquets were being placed in immovable containers that lacked inserts.

Floral baskets that are brought to cemeteries during the burial ceremony should be removed from the grave site once the flowers become wilted. If any of these baskets are being kept for recycling, then they should be scrubbed clean and stored indoors. Unfortunately, in many cemeteries the recyclable plastic baskets are often stored outdoors for many weeks before they are removed (see Fig. 2d). During this period the baskets may become suitable oviposition sites for mosquitoes like *Ae. albopictus*.

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