ment into the smaller canals which are usually richer in mosquito larvae than the larger ones where the fish had originally been stocked. Moreover, during the rainy season, which is also the peak season for malaria transmission, there are uncountable rainwater pools that furnish *An. arabiensis* with adequate breeding sites which are usually more favorable than irrigation canals but less favorable for the fish survival.

All the above factors, and possibly others, negate *Gambusia* as an efficient mosquito control measure during the peak season of malaria transmission. However, the fish are found to be effective against mosquito larvae in the irrigation canals during the dry season when the canals are the main breeding sites for mosquitoes. During this time the canals are also most suitable for the breeding and propagation of *Gambusia*.

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OVIPOSITION BEHAVIOR OF *AEDES TRISERIATUS* AND *AEDES HENDERSONI* ON THE DELMARVA PENINSULA[1]

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Aedes triseriatus (Say) and *Aedes hendersoni* Cockerell are sympatric species in eastern United States (Zavortink 1972). Intensive studies conducted on mosquito fauna and arboviruses of the Delmarva Peninsula by Saugstad et al. (1972) and LeDuc et al. (1975) revealed the presence of *Ae. triseriatus*, but did not detect *Ae. hendersoni*. The present study was undertaken to determine if the latter species occurs on the Peninsula and, if so, to describe its oviposition preference in relation to that of *Ae. triseriatus*.

One hundred and twenty ovitraps, prepared from aluminum cans painted black and containing balsa stick inserts (Novak and Peloquin 1981), were placed at ground level and at 3 and 6 m on trees in each of four 10-tree transects. Two transects were located in the Pocomoke Cypress Swamp (PCS), Worcester County, Maryland. The area and vegetation have been described in detail by Joseph and Bickley (1969) and Saugstad et al. (1972). These transects were established at the interface between the closed rootmat swamp and the upland hardwood forest, approximately 500 m apart. The more southerly transect was characterized by the nearby presence of discarded automobile tire casings that yielded *Ae. triseriatus* and *Ae. hendersoni* larvae. Two similar transects were established approximately 36 km east-southeast of the PCS in the Chincoteague National Wildlife Refuge (CNWR) at the southern end of Assateague Island, Accomack County, Virginia. This area was described in detail by Buescher et al. (1970). Transects at CNWR were located in deciduous woods, primarily *Quercus* spp., adjacent to freshwater swamps north and south of the island access road, approximately 0.5 km from the point where the access road enters the island. Traps were placed in the field on June 4,

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1983, and balsa strips were replaced and the water in the traps was replenished at biweekly intervals through September 26. Egg-laden strips were stored as described by Clark et al. (1982).

A portion of the eggs were hatched and reared to the 4th larval instar for identification, using characteristics described by Grimstad et al. (1974). The remaining larvae were reared to the adult stage for viral assay (Clark, unpublished data).

A total of 22,489 mosquitoes were hatched and reared to the 4th larval instar (6,297) or adult stage (16,192). The majority (17,353 or 77%) were from the PCS, with the remaining 5,136 from CNWR.

Substantial oviposition occurred from June 4 through August 31, but dropped precipitously in September (Table 1). Of the 17,353 mosquitoes from the PCS, the transect with scattered tire casings was the more productive transect, yielding 59% of the total. At CNWR, both transects were about equally productive, yielding 2,482 (48%) from the north and 2,651 (52%) from the south.

Of 5,248 larval mosquitoes examined from the PCS, 4,999 (95%) were *Ae. triseriatus* and 249 (5%) were *Ae. hendersoni*. In contrast, none of the 1,049 larval mosquitoes from CNWR were *Ae. hendersoni*. The mosquitoes examined as larvae accounted for 30 and 20% of the total collected and reared from the PCS and CNWR, respectively. This represents the first definitive report of *Ae. hendersoni* from this area of the Delmarva Peninsula. The absence of this species at CNWR is not understood.

Detailed examination and analysis of larvae reared from eggs deposited in ovitraps located on two trees at PCS revealed that *Ae. triseriatus* was always present and that there was a distinct seasonal pattern of oviposition for *Ae. hendersoni* (Fig. 1). Eggs of the latter species were only deposited before July 5 and after September 1. In contrast to this oviposition pattern, Scholl and DeFoliart (1977) and Sinsko and Grimstad (1977) reported oviposition activity of *Ae. hendersoni* from late May through early October.

As depicted in Fig. 1, *Ae. hendersoni* larvae emerged at ground level only from eggs laid during the period June 4–20. This group consisted of 10 (5%) out of 209 reared and identified from the two trees. During periods when *Ae. hendersoni* was present, this species appeared to preferentially oviposit in the traps at 3 and 6 m. Twenty-nine percent of larvae from eggs laid between June 4 and July 5 at the 6 m level were *Ae. hendersoni*.

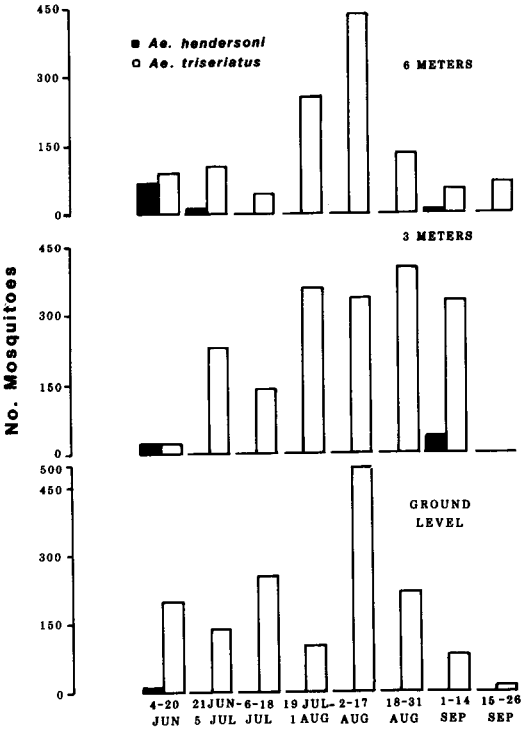

Fig. 1 Oviposition of *Aedes triseriatus* and *Ae. hendersoni* at three heights, Pocomoke Cypress Swamp, MD, 1983.

Over the entire period, only 7% of *Ae. hendersoni* originated from the ground level compared to 38% and 55% from 3 and 6 m, respectively. This stratification pattern corresponds closely to that reported by Sinsko and Grimstad (1977) in Indiana, where 3%, 42%, and 55% of *Ae. hendersoni* oviposition occurred at ground level, 10 ft [3.3 m] and 20 ft [6.7 m], respectively. Scholl and DeFoliart (1977) in Wisconsin found that 26% of *Ae. hendersoni* oviposition occurred basally, with 74% occurring from 3 to 9 m. In a

Table 1. *Aedes triseriatus* complex mosquitoes reared from eggs on the Delmarva Peninsula, 1983.

Site	June 4–July 5	July 6–Aug. 1	Aug. 2–Aug. 31	Sept. 1–Sept. 26	Total
Pocomoke Cypress Swamp, Maryland	4,384	4,556	6,585	1,828	17,353
Chincoteague National Wildlife Refuge, Virginia	2,040	2,524	520	52	5,136
Total	6,424	7,080	7,105	1,880	22,489

study of *Ae. triseriatus* oviposition between July 10 and August 28, Beier et al. (1982) in Indiana found 1.6% of the eggs deposited at 9.5 m above the ground were *Ae. hendersoni.*

This report from eastern U.S. confirms the presence of *Ae. hendersoni* as well as its preference for arboreal oviposition sites. The absence of *Ae. hendersoni* from prior reports in this locality may be the result of several factors. First, in the adult stage, this species is difficult to accurately separate morphologically from the closely related *Ae. triseriatus.* Based on this study, populations of *Ae. hendersoni* may not be very large, and when collecting near the ground, this species is not routinely sampled. Novak et al. (1981) found that almost all biting activity of *Ae. hendersoni* occurred in the canopy, approximately 21 m above the ground.

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DEPTH OF OVIPOSITION BY *ROMANOMERMIS CULICIVORAX* (NEMATODA: MERMITHIDAE) IN LOUISIANA RICELAND SOILS[1]

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Romanomermis culicivorax Ross and Smith is a mermithid nematode that parasitizes larval mosquitoes. Upon emergence from the host as a postparasite, the nematode burrows into the soil substrate of the aquatic habitat to mature, mate and reproduce. Oviposition begins about 25 to 30 days after host emergence (Petersen 1975).

Petersen et al. (1968) originally found *R. culicivorax* in ponds located in semiopen areas of piney woods near Lake Charles, LA. The soil type was a Kinder-Messer Complex (Kinder: fine-silty, siliceous, thermic, Typic Glossaqualf; Messer: Coarse-silty, siliceous, thermic, Haplic Glossudalf). In California studies, Washino and Westerdahl (1981) demonstrated successful cycling of *R. culicivorax* in three soil types characterized as a loamy sand, a fine sandy loam and a clay loam.

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