MORTALITY IN MITE-INFESTED, MALE *ANOPHELES CRUCIANS*

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Water mites of the species *Arrenurus pseudotenuicollis* Wilson parasitize adult anopheline mosquitoes (Lanciani and Boyt 1977, Lanciani 1986). Larval mites cling to host pupae and then attach to the emerging adult mosquitoes and begin feeding. The indirect route to adult hosts via pupae is required because host-seeking larvae of this mite live below the water surface. Consequently, the number of larval *A. pseudotenuicollis* on a mosquito cannot increase after emergence. Approximately six days after attachment to adult mosquitoes, the mites complete engorgement and detach from their hosts. Larvae that return to water metamorphose to nymphs, which, like adults, prey on ostracods.

The mite reduces longevity of *Anopheles crucians* Wiedemann (Lanciani and Boyt 1977) and *An. quadrimaculatus* Say (Lanciani 1986) in laboratory cultures. Furthermore, indirect evidence (Lanciani 1979b, Lanciani and Boyett 1980) suggests that parasitized female *An. crucians* also show increased field mortality. In the first of these field studies (Lanciani 1979b), the average number of mites per female *An. crucians* was shown to decrease as host age increased, just as expected if mosquitoes with large loads of mites died sooner than others. In that study, stylostomes were counted rather than mites, themselves. A stylostome is a tube-like structure that a feeding mite forms in the host, and each mite develops only one stylostome, which remains in the host after mite departure (Lanciani 1979a). Thus, despite mite detachment, the number of mites that had fed on the host can be accurately determined by counting stylostomes in chemically cleared mosquitoes (Lanciani 1979a). This study was conducted to determine whether average stylostome number decreases as age increases in male *An. crucians* sampled from the field.

Sampling began on October 22, 1977 and continued on every third day for a total of seven samples. All male *An. crucians* resting beneath a 119 m boardwalk near the shore of Lake Alice, Gainesville, Florida were collected with a battery-powered aspirator. (The mites were identified as *A. pseudotenuicollis* on the basis of adult males reared from parasitized *An. crucians*, but additional species of *Arrenurus* may actually be involved (Lanciani 1979a).) The samples were frozen and within four hours were separated into two groups: those with and those without attached mites. The mosquitoes were cleared in an acetic acid corrosive mixture and immersed in an acidic alcian blue solution to stain any stylostomes present (Lanciani 1979a). Mosquitoes of each group were individually inspected with a dissecting microscope to count stylostomes and were then placed into relative age classes. Younger mosquitoes were considered to be those that carried mites at the time of sampling; older mosquitoes were considered to be those that had stylostomes but no attached mites at the time of sampling. This method of determining relative age is based on the observation that mites, which attach only to emerging adult mosquitoes and begin feeding simultaneously on any one host, drop off more readily as they become engorged (Lanciani 1979a). Since time passes and, therefore, hosts grow older as mites become engorged and drop off, mosquitoes that have lost all of their mites are likely to be older on average than mosquitoes that still carry mites.

The average number of stylostomes per male mosquito with stylostomes was observed to be higher in younger than older mosquitoes on all but one date (Table 1). However, younger mosquitoes on a sampling date should be matched with older on a later sampling date for the most appropriate comparisons, i.e., comparisons within the same cohorts of mosquitoes. Although the correct sequential matching of sampling dates could not be determined, the results were unaffected: younger classes were always found to have a higher average number of stylostomes than older on any later sampling date (Table 1). Comparing younger males on a sampling date with older on the next sampling date

Table 1. Average number of stylostomes per adult male *Anopheles crucians* bearing at least one stylostome. Mosquitoes are divided into younger (those that carried mites at the time of sampling) and older (those that carried no mites at the time of sampling). Sample sizes are listed under column heading n.

	Younger		Older	
Date	$\bar{x}$	n	$\bar{x}$	n
October 22	6.32	25	4.22	18
October 25	6.52	37	3.17	41
October 28	4.77	40	5.18	39
October 31	5.58	38	4.07	30
November 3	5.67	60	3.63	63
November 6	6.39	49	3.42	74
November 9	5.75	79	3.27	66

(three days later) indicated significantly higher average stylostome numbers in younger males ($P < 0.025$, Wilcoxon signed rank test).

Male *An. crucians* in natural populations apparently die sooner as the number of mites feeding on them increases. Other hypotheses (e.g., differential dispersal of lightly and heavily infested mosquitoes) could explain the lower stylostome numbers in older male mosquitoes sampled from the field, but laboratory studies (Lanciani and Boyt 1977, Lanciani 1986) support parasitism as a likely cause.

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