DIFFERENTIAL FEEDING OF *CULEX TARSALIS* ON NESTLING AND ADULT BIRDS *

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INTRODUCTION. The blood-feeding habits of *Culex tarsalis* Coq. have been studied extensively by many workers because of the mosquito's importance in the transmission of western equine and St. Louis encephalitis viruses. It is generally accepted that *C. tarsalis* feeds readily on numerous species of birds, but very little attention has been given to the relative feeding preferences for different species or different individuals within a species.

Unpublished data accumulated at the Greeley Field Station from sentinel pigeon cages in 1955 and 1956 indicated that *C. tarsalis* mosquitoes usually took blood meals in cages which contained mixed adult and nestling birds but fed infrequently when only adult pigeons were present. Subsequent studies were undertaken by members of the Greeley and the Logan Field Stations to compare the numbers of *C. tarsalis* that would take blood meals from adult birds and the young of the same species.

COLORADO TESTS: *Methods and Materials.* The study in Weld County, Colorado, was begun in lowlands near the St. Vrain River where large numbers of *C. tarsalis* had previously been collected in light traps and resting stations. Shortly after the beginning of the study, however, the mosquito population in this locality suddenly decreased so dramatically that the project was moved to a typical Upper Sonoran prairie environment where an intermittent stream favored intensive mosquito breeding. The adult *C. tarsalis* population in this area was dense and remained so during the remainder of the study. The observations were made from the first part of July to the last of August, 1956.

Three modified stable traps with Egyptian-type baffles were placed in a row with a space of about 20 feet between each trap. Three to five adult birds were placed in an exposure cage within the first stable trap. In the second trap the same number of unfeathered to slightly feathered nestlings of the same species was placed in a one-pound coffee can with the original nesting material, and several adult birds were held in mosquito-proof cages for added attraction. Since mosquito feeding is known to fluctuate from night to night, a "blood feeding index" was obtained by placing three adult pigeons in the third trap each test night. The bias of position was lessened by rotating the host birds each afternoon in such a manner that the birds experienced one exposure period in each of the three traps. Mosquito collections were made from the traps the following morning.

One of the stable traps is shown in Figure 1. Traps were constructed of quarter-inch plywood facing on a frame of 2- by 2-inch wood with 18 x 14 mesh wire screen serving as the baffle material. The outside dimensions of the trap were 4x4x4 ft. with baffles on two sides 24 inches high.

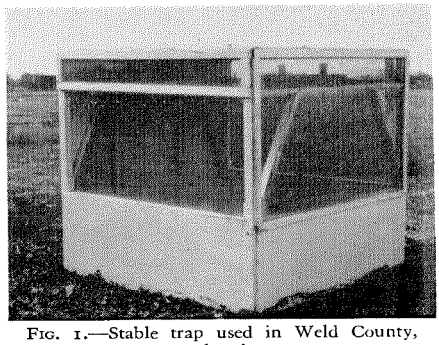

FIG. 1.—Stable trap used in Weld County, Colorado.

* From the Communicable Disease Center, Bureau of State Services, Public Health Service, U. S. Department of Health, Education, and Welfare, Greeley, Colorado, and Logan, Utah.

The main part of the baffle sloped inward 11 inches leaving a 1-inch-wide horizontal entrance between its upper margin and the inner margin of a horizontal shelf of screening 10 inches wide. A shelf at the bottom level of the baffle provided support for the test birds. Two by two mesh hardware cloth cages were used to hold the adult birds that were to be exposed to mosquitoes. The mosquito-proof cages used to hold the adult birds in the stable trap containing the exposed nestlings were constructed with a wood frame and covered with 18x14 mesh wire screen. The dimensions were 16x16x17 inches.

Results. The mosquitoes which entered the traps fed upon the nestling birds much more readily than upon the adults (Table 1). Nestling pigeons and barn swallows were the most efficient hosts. A very high percentage of the mosquitoes attracted to them took a blood meal. The adult pigeons seemed to be highly resistant to mosquito feeding even though they attracted relatively large numbers. The difference in engorgement rates between young and adult chickens was not as great as for the other species tested.

CALIFORNIA TEST: *Methods and Materials.* Four pigeons of the King breed, 2 adults and 2 squabs, were compared with respect to the attraction and feeding of *C. tarsalis* by exposure as bait in traps made from 120-pound lard cans. The 4-night test was conducted September 16–19, 1956, beside Poso Creek near the Oildale-Woody road in Kern County, California. The traps were suspended about 5 feet above the ground and slowly rotated for 2½ hours in a common circle 10½ feet in diameter. The apparatus used was a rotary similar to the device described in an earlier paper (Dow *et al.*, 1957), but differing in having a fixed post with the motor mounted near the top.

The 2 squabs, which were about 8–11 days old during the test, were removed from their nests in the late afternoon and returned the following morning. They were taken from 2 different nests in order to leave a sibling for the parents' attention and thus assure the continuation of their care. All 4 birds were tested each night in the same cages. The cages used for the squabs were provided with a hollowed nest of paper covered with a layer of plastic. Each cage was placed in a different one of the 4 traps each night, the test pattern being a randomized 4x4 Latin square.

Results. On the first 3 nights, which were warm and quiet, each trap collected from 112 to 456 female *C. tarsalis.* On the fourth night, which was still warm but comparatively windy, the catches ranged from 60 to 98 specimens. The percentages of the trapped mosquitoes which contained blood (Table 2) were reasonably consistent from night to night for each bird. The ranges for the squabs overlapped, as did those for the adults, but there was a wide gap between the highest percentage for either adult (24) and the lowest for either squab (55). The mean for both squabs was 82 percent, and for

TABLE 1.—*Culex tarsalis* mosquitoes caught in stable traps that were baited with adult and nestling birds of 4 species, Weld County, Colorado, July through August, 1956

Species of Bird Tested	Nestling Birds		Adult Birds	
	Total Mosquitoes Caught *	Percent Mosquitoes Containing Blood	Total Mosquitoes Caught *	Percent Mosquitoes Containing Blood
Pigeon (*Columba livia*)	291	96.1	239	6.2
English sparrow (*Passer domesticus*)	111	74.6	202	30.1
Barn swallow (*Hirundo rustica erythrogaster*)	585	97.9	437	32.6
Domestic chicken	131	81.8	104	51.1

* Numbers indicate totals for 3 nights' catches.

TABLE 2.—Attraction and feeding of female *Culex tarsalis* in rotary test of squabs and pigeons, Kern County, California, September 1956

	Squab A	Squab B	Adult A	Adult B
Wt. in gm., Sept. 20	304	332	482	569
Total *C. tarsalis* caught in 4 nights	932	608	1273	1047
Percent *C. tarsalis* with blood:				
First night	89	94	24	21
Second night	55	92	5	24
Third night	72	97	2	19
Fourth night	97	97	13	15
Whole test	74	94	9	21

both adults 15 percent. This difference was observed to be at least partly correlated with the activity of the birds during testing, the squabs being essentially motionless. The adults, however, tended to be restless, and adult B, especially, was inclined to assume fantastic contortions at the beginning of the test period.

DISCUSSION AND CONCLUSION. This study was designed to test whether mosquitoes, when once attracted to birds, were more likely to feed on nestlings or adults. Except in the California test, no attempt was made to compare their relative attractiveness. Since many species of birds nesting under natural conditions are in close proximity to their young during the hours of maximum *C. tarsalis* feeding activity, the amount of attractiveness of a bird nest is probably the sum of the attractiveness of the young and parent birds. Therefore, any difference in attractiveness between the young and adults would seem to be of minor importance.

The reason that a greater percentage of mosquitoes engorged themselves upon nestling birds is probably that the young birds were (1) nearly free of feathers and (2) more quiescent. The adult birds had a relatively hard "shell" of feathers which probably provided an efficient barrier to mosquito biting. The failure of mosquitoes to obtain blood through this barrier has been observed on several occasions in sentinel flocks of adult pigeons. Female *C. tarsalis* were observed to land on the feathers and eagerly seek an area of exposed skin. Usually, after several moments of probing with their proboscis, the mosquitoes would take flight. The few that did manage to consume a visible amount of blood did so by piercing the base of the beak, the legs, the feet, or the tissue around the eyes.

The present study indicates that nestling birds rather than adult birds were more frequently used as hosts by mosquitoes and may therefore be more important as reservoirs of encephalitis viruses. If this occurs under natural circumstances, birds that nest during the encephalitis season may be more important as reservoirs of virus than those that do not. Other factors, however, such as nesting sites, roosting sites, and total numbers, may modify or even negate the differential feeding on adults and young.

Reference Cited

DOW, R. P., REEVES, W. C., and BELLAMY, R. E. 1957. Field tests of avian host preference of *Culex tarsalis* Coq. Am. J. Trop. Med. & Hyg. 6(2):294–303.