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WYEOMYIA MITCHELLII: OBSERVATIONS ON DISPERSAL, SURVIVAL, NUTRITION, INSEMINATION AND OVARIAN DEVELOPMENT IN A FLORIDA POPULATION[1]

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ABSTRACT. Seven mark-release-recapture experiments were conducted with a *Wyeomyia mitchellii* population in a wooded area near Vero Beach, Florida. Adult mosquitoes, marked with radiophosphorus during their fourth larval instar, were released once each month from March to October, 1977, either unfed or sugar-fed after emergence. Marked and unmarked adults were collected up to 100 meters distance from the release point in all 4 quadrants, with an average recovery rate of 5.2% in the 7 experiments. Dispersal was independent of the age of the mosquitoes at release time. Daily survival rates ranged from 0.76 to 0.87 for males and 0.74 to 0.91 for females, during different experiments.

Marked unfed adults first fed on nectar after release and soon thereafter started host-seeking, whereas sugar-fed females began host-seeking on the day of release. Almost all of the host-seeking females collected were inseminated. Host-seeking appeared to be continuous once started. Gravid females were collected from days 4 to 7 after emergence. Most females were parous from days 5 to 8. The average number of eggs in gravid females was 81 ± 6.

INTRODUCTION

In central and south Florida, *Wyeomyia mitchellii* (Theobald) occurs only in hard wood (oak and/or cypress) hammocks and forests where epiphytic bromeliads occur (King et al. 1960). Its immature stages are found with those of *Wyeomyia vanduzeei* Dyar and Knab in water held in the leaf axils of these epiphytic bromeliads, mainly *Tillandsia utriculata* L., throughout the year except when the leaf axils become dry, and the adults rest on trunks of trees (King et al. 1960). It has also been reported from Jamaica, the Atlantic slopes of Mexico, Cuba and Hispaniola, where it is found in the leaf axils of epiphytic and terrestrial bromeliads, "wild coco yam" and in the flower bracts of a large heliconia (Belkin et al. 1970, Knight and Stone 1977). *Wyeomyia mitchellii* females emerged from pupae collected along with *Wy. vanduzeei* from bromeliad plants in Vero Beach are anautogenous, while those of *Wy. vanduzeei* are autogenous (Nayar et al. 1979a). In Florida, this day-biting pest of man and animals is not known to be a vector of any mosquito-borne disease (Edman and Haeger 1977). A few innocuous viruses (Illheus and Wyeomyia) have been isolated from species of

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Wyeomyia in the West Indies and Central America (Theiler and Downs 1973).

Very little is known of the bionomics of adult *Wy. mitchellii* or of factors that affect the distribution and dispersal of this mosquito in woodland areas. The purpose of this study was to establish the dispersal patterns, daily rate of survival, rate of insemination, patterns of sugar-feeding and host-seeking, and ovarian development for a marked F_1 Florida population of *Wy. mitchellii* in nature.

MATERIALS AND METHODS

THE STUDY AREA. A tract of land 0.04 km² in Tiger Hammock, where an indigenous population of *Wy. mitchellii* exists, was used for this study (Fig. 1). The vegetation consists mostly of live oak (*Quercus virginiana*), laurel oak (*Quercus laurifolia*), saw palmetto (*Serenoa repens*) and Brazilian pepper (*Schinus terebinthefolius*), forming areas of young and mature hammocks (Fig. 1). The surrounding land is a mixture of pine, saw palmetto,

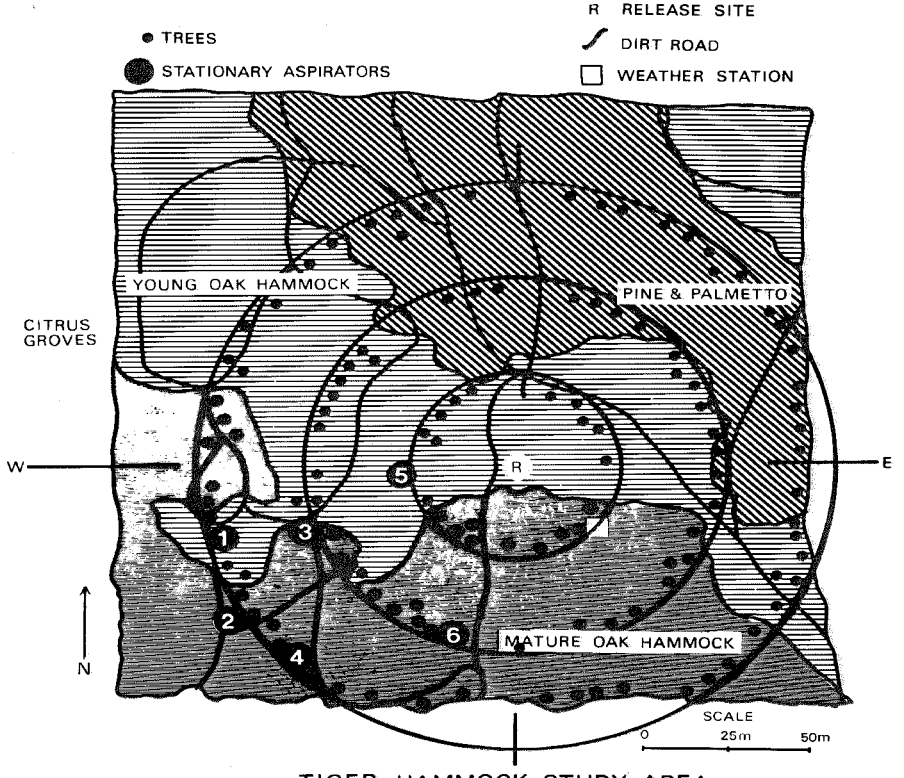

Fig. 1. Schematic of the study area in the Tiger Hammock showing distribution of different vegetation, trapping sites, release site, location of weather-stations and the roads. The study area was divided into 4 quadrants and all collections were made in 3 rings, 33 m apart as well as in 4 quadrants.

dairy pasture, citrus groves and some oak hammock and residential land as described earlier (Nayar et al. 1980). Trails and vegetation groupings in the study area had previously been mapped (Nayar 1981, Nayar et al. 1980). The release site (R) and other parameters were the same as for an earlier study (Nayar 1981).

EXPERIMENTAL METHODS. a) *Rearing and marking of mosquitoes:* Eggs were procured from females that had been reared from field collected larvae and pupae and allowed to mate in the laboratory. After blood-feeding, females were allowed to oviposit on a washed and trimmed bromeliad plant placed in a beaker with oak infusion water in the leaf axils. The eggs were fully embryonated by 60 hr. In order to collect and accumulate enough eggs for a release experiment, the eggs were collected on moist filter paper and maintained at 27°C for a week or at cooler temperature, if held longer. When enough eggs were available, they were hatched by washing them into a pan of water (Nayar et al. 1978).

Larvae were reared at a constant temperature (27°C) with 500 larvae/pan (50 × 25 × 4 cm) in 1 liter of distilled water with 200 mg of brewer's yeast added daily for 18 days (Nayar and Pierce 1977, Nayar et al. 1978). The number of larvae reared in each of the 7 experiments varied from 5,000 to 25,000. Under these conditions the minimum larval duration was 312 hr. with the 4th instar lasting 4 to 5 days (Nayar et al. 1978). On day 2 of the 4th instar, larvae were strained from rearing pans, placed in the larval marking pans, and treated at a dose of 0.3 μCi/ml of $H_3{}^{32}PO_4$ solution for 24 hours. Radioactive phosophorus was obtained as Orthophosphoric acid ($H_3{}^{32}PO_4$) in 0.02 M HCl. All readings were made 1 cm from the end of the Geiger-Müller tube connected to a Tracer lab. Scaler or Nucleus Scaler Model 500 (Nayar et al. 1979b, Nayar 1981). The resulting mean ± S.D. radioactivities for all ^{32}P-marked *Wy. mitchellii* broods, based on samples of 20 individuals of each stage from each experiment, were as follows: 9719 ± 722 cpm/larva, 7156 ± 650 cpm/pupae, 5680 ± 435 cpm/male and 8015 ± 623 cpm/female.

Pupation occurred over a 4-day period. Pupae were collected daily by floatation using ice-cold water. Pupae thus procured were maintained in a LD 12:12 light regime and at low temperatures (18–22°C) for a predetermined time period so that emergence of the entire brood could be synchronized into a peak, so that 95% of the adults emerged within a 20 hr period, when brought back to 27°C and allowed to emerge in radiation-leak proof cages (Nayar et al. 1980). Emerged adults were held in these cages until released in the study area.

Aliquots of 100 males and 100 females of both marked and unmarked adults reared in these experiments were maintained in the laboratory on water, 10% sucrose solution, and 10% sucrose solution plus blood meals on chicken provided twice a week, at 27°C under LD 12:12 and 70–75% RH. The 50% survival times for both marked and unmarked adults, were 3.8 and 4.5 days for males and females, respectively, on distilled water, and 24 days for males and 33 days for females on a 10% sucrose solution. All eggs laid by marked females and held beyond the incubation period hatched after completion of the incubation period.

b) *Releasing of adults:* All releases were made between 0700 and 0800 hr. Three aliquots of about 200 adults were taken from each cage prior to release to determine the sex ratios, which were found to be 1:1.

c) *Collection of adults:* Adults of *Wy. mitchellii* were collected between 0800–1200 hr. daily by 2 standardized methods: 1) Resting adults were collected from tree trunks with a portable hand aspirator (0.5 m long, 20 cm diam) powered by a 12 volt automobile battery (Nayar 1981). For these collections, 120 oak trees of approximately equal diameter trunks were marked near the periphery of the circumference of each of the 3 rings, 33 m apart, starting from the release site (Fig. 1). Twenty of these trees were in the inner-

most ring, 40 trees in the middle ring and 60 trees in the outer ring. The study area was also divided into 4 quadrants, so that 30 trees were located in each quadrant (Fig. 1). Resting adults were collected daily for 12 days from alternately marked tree trunks in each ring from each quadrant. 2) Host-seeking adults were collected over CO_2 bubbled through a beaker of water with stationary AC electric aspirators described earlier (Nayar 1981). Six traps were stationed 33 m apart in the southwest quadrant, one at 33 m from release point (Trap. no. 5), 2 traps at 66 m (Traps no. 3 and 6) and 3 traps at 100 m (Traps no. 1, 2 and 4) (Fig. 1).

d) *Experimental design:* Seven experiments were conducted from late March through October 1977. Varying numbers of ^{32}P-marked *Wy. mitchellii* males and females, in equal numbers, with or without prior sugar-feeding were released.

Experiment 1 (March-April), Expt. 2 (April), Expt. 5 (August) and Expt. 6 (September): Newly emerged unfed marked adults were released in each experiment. The oldest adults in these experiments were 24 hr old.

Experiment 3 (May), Expt. 4 (July) and Expt. 7 (October): Newly emerged adults were maintained ad lib. on 10% sucrose solution for 24 hr prior to release. The oldest adults in these experiments were 48 hr old.

e) *Handling of collections:* Upon arrival at the laboratory, adults were lightly chloroformed, and narcotized mosquitoes were shaken onto a clean sheet of paper and radioactive mosquitoes were retrieved as soon as possible, using a portable Geiger-Müller β-scanner. The background of the scanner varied from 20–30 cpm. The radioactive mosquitoes were counted, recorded, blood-fed females separated, and then all were read for residual radioactivity (Nayar et al. 1979b). An aliquot of 30 unmarked and all of the marked females were carefully dissected in physiological insect saline to examine the spermathecae for the presence or absence of sperm, the ovaries were removed to examine for parity by the dilatation method of Polovodova (cf. Detinova 1962) and the stage of maturation of the ovaries after Christophers (1911) as modified by Mer (1936). After removing the ovaries and spermathecae, the remainder of each female was analyzed for free nectar sugars by the method of Nayar (1978).

f) *Weather monitoring:* Both temperature and relative humidity were measured hourly, but means are given here only for the period during which collections were made (0800–1200 hr). During Expt. 1 to 3 (March to May), mean temperatures varied from 23.7–24.3°C, with mean relative humidity of 54.2–57.4%. No rainfall occurred during Expt. 1, 15.5 mm during Expt. 2 and 11 mm during Expt. 3 (9 mm fell during the day of release).

During Expt. 4 to 6 (July to September), mean temperatures varied from 26.5–27.8°C, mean relative humidity from 73.4–82.4% and rainfall of 33 mm in Expt. 4, 54 mm in Expt. 5 (14 mm on the day of release) and 24 mm in Expt. 6 (22 mm on the day of release). Also during the interval between Expt. 4 and 5 and 5 and 6 there was substantial amount of rainfall. During Expt. 7 (October), the mean temperature was 23.6°C, the mean relative humidity 67.2% and rainfall 21 mm (16 mm fell on the day of release).

RESULTS

RECOVERY OF MARKED AND UNMARKED ADULTS. From 79,000 *Wy. mitchellii* adults marked with radiophosphorus and released in the 7 experiments in 1977, 4134 (5.2%) were recaptured [2502 (6.4%) males and 1632 (4.1%) females] along with 1800 unmarked males and 2151 unmarked females (Table 1). The mean ratio of marked to unmarked (1:0.7 for males and 1:1.3 for females) varied among experiments (1:0.1 to 1:1.6 for males and 1:0.4 to 1:4.8 for females, Table 1). Marked and unmarked adults were collected in each collection by both methods which indicated that the marked adults released mixed thoroughly with

Table 1. Number of *Wyeomyia mitchellii* captured in 7 experiments in 1977, and ratio of marked to unmarked adults. Different numbers of marked adults were released in each experiment. Collections were made for 12 consecutive days.

Expt. no.	Dates	No. marked released	Total no. adults collected				Ratio Marked: unmarked		Marked as % of released		Total marked adults	Marked adults % of released
			Unmarked		Marked							
			♂	♀	♂	♀	♂	♀	♂	♀		
1	28 Mar–8 Apr.	5,000	29	116	26	35	1:1.1	1:3.3	1.0	1.4	61	1.2
2	18–29 Apr.	10,000	13	71	130	171	1:0.1	1:0.4	2.6	3.4	301	3.0
3	9–20 May	10,000	81	125	185	265	1:0.4	1:0.5	3.7	5.3	450	4.5
4	11–22 Jul.	12,000	554	560	749	447	1:0.7	1:1.3	12.5	7.5	1196	10.0
5	8–19 Aug.	8,000	402	476	246	99	1:1.6	1:4.8	6.2	2.5	345	4.3
6	6–17 Sept.	16,000	252	428	302	298	1:0.8	1:1.4	3.8	3.7	600	3.7
7	3–14 Oct.	18,000	469	375	864	317	1:0.5	1:1.2	9.6	3.5	1181	6.6
Total		79,000	1800	2151	2502	1632	1:0.7	1:1.3	6.4	4.1	4134	5.2

the wild adult population in the study area.

The lowest percentage recovered was 1.2% in Expt. 1 (early spring) and the highest of 10.0% in Expt. 4 (mid-summer) with the recoveries in the other 5 experiments ranging from 3.0% to 6.6%.

Wyeomyia mitchellii males attracted to CO_2 vapors formed 61.5% of the marked adults recaptured as host-seeking by stationary aspirators (Table 2).

DISPERSAL OF ^{32}P-MARKED ADULTS. Marked adults dispersed from the release point to the periphery of the circumference of the 100 m ring and throughout the 4 quadrants of the study area (Table 2). In all experiments, dispersal appeared random, based on recapture patterns. The ratio of marked to unmarked adults indicated that fewer unmarked adults were collected from the center and the northeast quadrant than the other 3 quadrants (Table 2). The host-seeking adults collected over CO_2 in the southwest quadrant did not decrease the percentage of resting adults collected in the southwest quadrant or in the other 3 quadrants (Table 2).

THE DAILY SURVIVAL RATE. The number of marked mosquitoes of both sexes recaptured after each release generally increased for the first 2 to 3 days and declined slowly on successive days (Table 3). When these data were plotted on semilog scale, all the points from day 2 or 3 to day 11 or 12 fell more or less on straight lines, indicating that the daily survival rate was more or less constant for each sex 2 or 3 days after release. Following Gillies' (1961) suggestion that the first 2 or 3 days' recoveries should be excluded, the daily survival rate p was then calculated from the frequency of the numbers caught on subsequent days, starting from the day the maximum number of adults of each sex were captured. The regression coefficient (β) and corresponding p values for the logarithm of the numbers of males recaptured varied from experiment to experiment (Table 3). Similarly, the regression coefficient (β) values for

Table 2. Total number of ^{32}P-marked adults of *Wyeomyia mitchellii* recaptured in 7 experiments in 1977 at indicated distances and direction. Different numbers were released in each experiment (cf. Table 1).

	Resting collections with hand-aspirators on tree trunks										Host-seeking collected with traps over CO_2	
	Total recoveries at different distances in different directions from release point.											
	< 33 m		SW		33–100 m SE		NE		NW		0–100 m SW	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Unmarked adults												
Total from 7 experiments	149	214	429	302	320	302	68	146	97	215	737	974
% of total	14.0	18.2	40.4	25.6	30.2	25.6	6.4	12.4	9.1	18.2	43.1	56.9
Marked adults												
Total from 7 experiments	500	300	358	169	456	235	316	212	132	154	740	562
% of total	28.4	28.0	20.3	15.8	25.9	22.0	17.9	19.8	7.5	14.4	61.5	38.5
Ratio of marked to unmarked	1:0.3	1:0.7	1:1.2	1:1.8	1:0.7	1:1.3	1:0.2	1:0.7	1:0.7	1:1.4	1:1	1:1.7

females recaptured varied from −0.128 to −0.043 for the 7 experiments as did the corresponding p values which varied from 0.74 to 0.91 (Table 3). For all experiments, 44.7% of all males collected were recovered during the first 4 days after release with 32.3% in the second 4 days and 23.1% in the next 4 days (Table 3). Similarly, 40.4% of the females were collected during the first 4 days, and then almost equal numbers (29.1% and 30.4%) in next 2, 4 day collections. Individual experiments also reflected these general patterns of recapture.

The daily survival rate of recaptured adults of both sexes in all 7 experiments had a regression coefficient (β) for males of −0.084 and for females of −0.06, with the corresponding p value of 0.83 for males and 0.87 for females (Table 3).

PHYSIOLOGICAL STATUS OF RECAPTURED MARKED FEMALES. *Insemination.* Insemination rates in recaptured females varied from experiment to experiment according to the time of the year and the nutritional state at release. In Expt. 1 and 2, with mean temperatures of 24.2°C and 23.7°C, respectively, and where adults were released at the age of 24 hr, the first inseminated females were recaptured on day 3 after release, with all recaptured females inseminated by day 6 in Expt. 1 and day 5 in Expt. 2. In Expt. 5 and Expt. 6, also released at the age of 24 hr, when mean temperatures were 26.5°C and 27.3°C, respectively, insemination was detected on day 2, and by day 4 all captured females were inseminated, thus suggesting that at higher temperatures insemination occurred earlier. However, when sugar-fed adults were released in Expt. 3 and 4, and the mean temperatures were higher, more than half of the recaptured resting females and all of the host-seeking females were inseminated on the day of release, and all females captured on day 2 were inseminated. In Expt. 7, where the mean temperature was lower (23.6°C), 100% insemination was delayed. These results suggested that sugar-feeding and higher temperature after release led to earlier insemination.

Table 3. Number of ^{32}P-marked males and females of *Wyeomyia mitchellii* recaptured on days 1–12 after release (combined-attracted to CO_2 and resting adults) in 7 experiments in 1977.

Expt. no.	Days after release												Total	Daily survival rate p	Regression coefficient (β)
	1	2	3	4	5	6	7	8	9	10	11	12			
Males															
1	0	1	2	4	5	5	1	1	1	4	0	2	26	0.84	−0.078
2	1	17	20	16	17	9	12	6	9	3	5	15	130	0.82	−0.087
3	3	11	18	10	25	23	21	14	22	13	18	7	185	0.87	−0.061
4	24	149	129	85	84	17	38	22	71	54	40	36	749	0.85	−0.071
5	5	6	46	43	29	10	14	24	24	17	11	17	246	0.86	−0.063
6	34	11	52	45	36	14	23	22	20	15	19	11	302	0.82	−0.084
7	28	100	145	113	116	48	78	93	68	56	18	1	864	0.76	−0.120
Total	95	295	412	316	312	126	187	182	215	162	111	89	2502	0.83	−0.084
Percent recovered	3.8	11.8	16.5	12.6	12.5	5.0	7.5	7.3	8.6	6.5	4.4	3.6			
		44.7				32.3				23.1					
Females															
1	0	1	9	5	4	4	1	4	2	2	2	1	35	0.77	−0.113
2	0	20	29	15	15	11	9	8	10	21	13	20	171	0.91	−0.043
3	6	50	31	8	30	20	25	19	23	14	24	15	265	0.90	−0.048
4	17	69	52	22	51	17	36	33	41	42	43	24	447	0.87	−0.059
5	2	10	21	14	3	1	4	7	13	10	5	9	99	0.88	−0.058
6	28	13	46	29	31	21	21	18	23	16	28	24	298	0.89	−0.051
7	29	49	53	31	27	8	13	34	34	27	8	4	317	0.74	−0.128
Total	82	212	241	124	161	82	109	123	146	132	123	97	1632	0.87	−0.06
Percent recovered	5.0	13.0	14.8	7.6	9.9	5.0	6.7	7.5	8.9	8.1	7.5	5.9			
		40.4				29.1				30.4					

Most of the host-seeking females even though they were only 2 days old at capture were 100% inseminated, indicating that in nature in this species insemination is perhaps prerequisite for blood-feeding.

Nectar-feeding. Resting non-blooded females captured in the 7 experiments were highly positive for glucose (50.0–83.6%) as compared to fructose (9.9–33.3%) (Table 4). Blood engorged resting females showed a similar pattern, but had a wider range in both glucose and fructose (Table 4). Host-seeking, non-blooded females were highly positive for glucose as compared to fructose (Table 4). Blood-engorged females showed a much lower percentage of positives for both glucose and fructose than non-blooded ones. Marked resting males showed similar percentages positive for glucose and fructose as the females (Table 4). Marked females recovered (resting and host-seeking) did not show any distinct peaking pattern on a day to day basis of nectar-feeding, but apparently had a continuous intake of nectar throughout the duration of the experiments.

Host-seeking and blood feeding. Unfed females (Expt. 1, 2, 5 and 6) first sought hosts on the second or third day after release, whereas sugar-fed females (Expt. 3, 4 and 7) started to seek hosts on the day of release (Table 5). About 40.2% of both unfed and sugar-fed females were captured during the first 4 days after release, and after that host-seeking was fairly constant, with 29.7% in the second 4 days and 30.1% in the third 4 days of the experiments. This suggested that except for the first small peak, host-seeking was continuous.

Only 48 (9.3%) of the host-seeking females recaptured already contained blood indicating that some interrupted blood-feeding probably occurs in nature in this species (Table 5). Of the blood-fed females collected, 469 (90.7%) were captured resting on the tree trunks; these blood-engorged females made up 43.2% of the total 1087 resting females collected in all 7 experiments.

Ovarian development. Females of *Wy. mitchellii* emerged with oocytes in stage 1, and after nectar- and blood-feeding, resting gravid females with stage V eggs were collected at the age of 5 days in

Table 4. Number tested and percentage of ^{32}P-marked *Wyeomyia mitchellii* adults positive for nectar sugars during 7 experiments conducted in 1977. Adults in experiments 3, 4, and 7 fed on sucrose before release.

	Resting females			Host-seeking females			Resting males		
	No.	Percentage with		No.	Percentage with		No.	Percentage with	
Expt. no.	tested	glucose	fructose	tested	glucose	fructose	tested	glucose	fructose
				Non-blooded females					
1	27	66.7	11.1	1	0	0	20	70.0	20.0
2	94	50.0	13.8	21	71.1	4.8	65	76.9	16.9
3	69	75.4	20.3	60	81.2	13.3	77	81.8	19.5
4	121	65.3	9.9	106	65.1	8.5	82	40.2	1.2
5	33	78.8	33.3	36	63.9	11.1	81	77.8	8.6
6	74	73.0	23.0	93	50.5	9.7	84	73.8	20.2
7	67	83.6	29.9	129	79.8	33.3	78	80.8	42.3
				Blooded females					
1	6	50.0	16.7	0	0	0			
2	53	50.9	7.5	3	33.3	0.0			
3	78	42.5	21.8	15	40.0	0.0			
4	135	60.0	9.6	2	50.0	0.0			
5	18	83.3	22.2	1	100.0	0.0			
6	57	70.1	22.8	19	15.8	0.0			
7	35	94.3	42.9	9	55.5	22.2			

Table 5. Total number of ^{32}P-marked female *Wyeomyia mitchellii* recaptured during 7 experiments in 1977 seeking host, captured in stationary traps, and blood-fed captured resting on tree trunks and in stationary traps.

	Days after release												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Host-seeking females captured in stationary traps													
a) Released unfed in Expt. 1, 2, 5 and 6.	1	11	33	24	7	10	13	12	21	11	12	19	174
b) Released after sugar-feeding in Expt. 3, 4 and 7.	6	55	59	30	27	17	34	42	32	23	32	14	371
Total (%)			219 (40.2%)			162 (29.7%)				164 (30.1%)			545
Blood-fed females captured on tree-trunks*—stationary traps**													
a) Released unfed in Expt. 1, 2, 5 and 6.	0	0	14*–4**	13–6	25–5	12–1	13–0	12–1	16–2	23–1	23–1	18–0	169*–21**
b) Released after sugar-feeding in Expt. 3, 4 and 7.	0	8–0	22–2	20–1	43–2	18–2	29–2	28–4	47–6	38–4	26–2	21–2	300–27
Total (%)			77–13 (17.4%)			180–17 (38.1%)				212–18 (44.5%)			469–48 (90.7%–9.3%)

*— ** Resting and host-seeking females.

Expt. 2, 4 and 6; 6 days in Expt. 3 and 7; 8 days in Expt. 5 and 9 days in Expt. 1. This suggested that with increased average daily temperatures during the first few days of each release, less time was needed for egg maturation. The mean number of eggs counted in marked gravid females was almost identical with the mean number observed in unmarked females, e.g., 80.5± 6.2 versus 78.6 ± 7.2.

Parous *Wy. mitchellii* were collected soon after the gravid females appeared in the collections. It was not possible to determine the number of times the parous females laid eggs, since standard methods of age grading could not be applied to the field collected *Wy. mitchellii*. Therefore, only females with sac-like ovarioles (which appear soon after oviposition) and females with distinct dilatation were classified as parous. None of the parous females recaptured had multiple dilatations. Host-seeking females collected during the 7 experiments had mostly stage II follicles with an occasional female having stage III to V follicles.

DISCUSSION AND CONCLUSIONS

Wyeomyia mitchellii is a restricted-habitat forest mosquito because its distribution is controlled by the presence of epiphytic bromeliad plants on hardwood trees (Edman and Haeger 1977, King et al. 1960). Apparently the marked population was assimilated into and behaved as the natural population since both ^{32}P-marked and unmarked adults were found in similar proportions in each collection site. Recovery rates ranged from a low 1.2% of the marked released adults (Expt. 1 conducted during March–April), to a high of 10.0% (Expt. 4 conducted in July), with an average of 5.2% in all 7 experiments. The results indicated that the weather conditions prevalent during the different experiments probably affected the rate of recovery of adults. The low mean temperature (24.2°C), low humidity (57.4%) and absence of rainfall prior to or during Expt. 1 led to the recapture of the lowest percentage (1.2%) of the released adults, as compared with Expt. 4, with the highest mean temperature (27.8°C), high mean humidity (73.4%) and moderate amount of rainfall (33 mm), where 10.0% of released adults were recaptured. Similar high percentages of recoveries were made in experiments conducted with *Aedes aegypti* (Linn.) under similar environmental conditions (Nayar 1981). Higher yields of adults also have been made in other mosquito species when the recoveries of marked mosquitoes were confined to restricted habitats and, as far as possible, to the natural habitats, e.g., *Culex nigripalpus* Theobald (Nayar et al. 1980), *Wy. vanduzeei* (Frank and Curtis 1977), *Aedes sierrensis* Ludlow (Bennett 1980) and *Ae. aegypti* (Nayar 1981). Unfavorable weather conditions in Expt. 1 were associated with the lower daily rate of survival as compared to rates during favorable weather conditions as in Expt.4. Higher daily survival rates for both males and females were generally observed in Expt. 2 to 5 and Expt. 7 conducted during late spring, summer and early fall months, with the exception of Expt. 6, in which the daily survival rate was low. We have not been able to associate this low daily survival rate with any obvious change in weather conditions. The higher daily survival rate of *Ae. aegypti* was similarly associated with favorable weather conditions (Nayar 1981).

Weather conditions did not seem to affect dispersal of *Wy. mitchellii* within the study area, as adults dispersed well throughout the 4 quadrants up to 100 m, in all 7 experiments.

The range of physiological parameters, such as insemination, nectar-feeding, host-seeking and ovarian development of *Wy. mitchellii*, which were measured after release, were with a few exceptions similar to those reported for *Ae. aegypti* and *Cx. nigripalpus* (Nayar 1981, 1982). Insemination started 1 to 3 days after release, and all females were inseminated within 2 to 5 days, depending on the temperature during the experiment. At

higher temperatures, insemination took place earlier than at lower temperatures. Sugar-feeding prior to release helped in accelerating insemination as these females were inseminated on the day of release.

Both male and female *Wy. mitchellii* fed heavily on nectar-sugars after their release, as most adults collected had stored reserves of glucose. A few adults also had fructose, which indicated that these adults had recently (within hours) acquired nectar-sugars.

Host-seeking and blood-seeking in *Wy. mitchellii* followed nectar-feeding and insemination, as almost no virgin females were collected either host-seeking or blood-fed. In this regard, *Wy. mitchellii* differs from both *Ae. aegypti* and *Cx. nigripalpus*, in which virgin females were collected seeking hosts (Nayar 1981, 1982). Thus, in this species insemination is apparently prerequisite for host-seeking and blood-feeding. Contrary to the observed behavior in *Ae. aegypti* and *Cx. nigripalpus*, where host-seeking occurred in distinct peaks (Nayar 1981, 1982), host seeking in *Wy. mitchellii* was continuous once started, with blood-fed females collected daily in almost equal numbers after the second or third day of release.

Female *Wy. mitchellii* emerge with their ovarian follicles in stage I, and, soon after feeding on nectar-sugars and blood, the follicles start to mature beyond stage II, and gravid females occur by day 5 at the earliest in summer and a little later in experiments conducted during spring and fall. There was no evidence of reduction of fecundity from the marking technique as both the marked and unmarked recaptured gravid females matured approximately the same average number of eggs.

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