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Culex nigripalpus: A NATURAL VECTOR OF WILD TURKEY MALARIA *(Plasmodium hermani)* IN FLORIDA[1]

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Abstract: During 1977 and 1978, more than 21,000 female mosquitoes of 15 species were live-trapped in south Florida where high numbers of wild turkeys *(Meleagris gallopavo)* are known to harbor malarial infections. By inoculation of mosquito extracts into uninfected domestic poults, the presence of sporozoites of *Plasmodium hermani* was demonstrated in *Culex nigrapalpus.* This mosquito, previously shown to be a competent experimental vector, is believed to be the primary natural vector of wild turkey malaria in Florida.

INTRODUCTION

Three species of blood protozoans *(Haemoproteus meleagridis, Leucocytozoon smithi* and *Plasmodium hermani)* are prevalent in populations of wild turkeys *(Meleagris gallopavo)* in Florida.[2] As part of a continuing study of the host-parasite relationships of these hematozoans, the vectors of *Plasmodium hermani* have been investigated. Two reports on experimental mosquito transmission of this malaria have been published.[4,7] The present report is concerned with attempts to determine the natural vector of this parasite.

MATERIALS AND METHODS

Blood-seeking female mosquitoes were live-trapped in CO_2-turkey-baited traps,[3] in wild turkey roosting habitat at Lykes Fisheating Creek Wildlife Management Area (Glades County, south Florida). Trapping was carried out on a weekly or biweekly basis from July to October, 1977 and August to October, 1978. These seasons were selected because a previous study in 1976 (Forrester, unpubl.) had shown that transmission of *P. hermani* occurred at that time of year. During the mosquito trapping periods, broad-breasted white domestic turkey poults (2-3 weeks of age) were exposed as sentinels to monitor transmission activities. These sentinel birds had been reared in an insect-proof isolation room. After a two-week period of exposure in the field each month, they were returned to isolation where they were examined for *P. hermani* infections by blood smear thrice weekly for the next 5 to 6 weeks. Smears were air-dried, fixed in 100% methanol and stained with Giemsa. Living mosquitoes were transported to the laboratory where they were anesthetized with chloroform, separated into groups according to species, placed in holding cages (40 cm^2) and maintained on a 10% sucrose solution for up to 2 weeks.

Mosquitoes in lots of 200 were separated into smaller cages ($16 \times 16 \times 30$ cm) and maintained on water for a day before using them in transmission studies. The next day, turkey poults (1-4 weeks of age) were strapped individually to the screen-wire side of the cages and

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TABLE 1. Wild-caught mosquitoes from Fisheating Creek tested for *Plasmodium hermani* sporozoites in 1977 and 1978.

Mosquito	Examination Method*	No. Mosquitoes Examined	No. Poults Exposed	No. Poults Positive
Culex nigripalpus	B.F.	5,124	98	0
	INOC.	9,747	193	3
Wyeomyia vanduzeei	B.F.	525	9	0
	INOC.	1,013	10	0
Culex erraticus	B.F.	361	3	0
	INOC.	85	2	0
Mansonia dyari	B.F.	0	—	—
	INOC.	251	7	0
TOTALS		17,106	322	3

*BF - Mosquitoes were allowed to take a blood meal on the recipient poults.
INOC - Mosquito extracts were inoculated into the recipient poults.

mosquitoes were allowed to take a blood meal. Simultaneously, other mosquitoes in lots of 50 to 100 were macerated in a Ten Broeck tissue grinder in 0.5-1.0 ml of saline (0.75% NaCl) and the resulting extract was strained throughh60 and 100 mesh screens to remove large particulate matter and injected either intraperitoneally (IP), intramuscularly (IM), or intravenously (IV) into uninfected poults. Turkeys treated by these methods were then maintained n a mosquito-proof isolation room and blood smears were prepared from each recipient poult thrice weekly for the next 5 weeks to detect malaria infections.

RESULTS AND DISCUSSION

Over 21,000 female mosquitoes of 15 species were collected in the CO_2-turkey-baited traps during the 1977 and 1978 collecting periods. These included *Anopheles crucians* (4),[4] *Anopheles quadrimaculatus* (5), *Aedes taeniorhynchus* (6), *Aedes infirmatus* (26), *Culiseta melanura* (1), *Culex nigripalpus* (18,093), *Culex salinarius* (2), *Culex erraticus* (515), *Psorophora columbiae* (60), *Psorophora ferox* (10), *Psorophora ciliata* (1), *Coquillettidia perturbans* (198), *Mansonia titillans* (13), *Mansonia dyari* (266), and *Wyeomyia vanduzeei* (1,957). Only four of these occurred in numbers large enough to warrant study as vectors. These included *C. nigripalpus,* which was the most numerous species, *W. vanduzeei, C. erraticus,* and *M. dyari.* The total numbers of each species that were tested for vector potential are presented in Table 1.

None of the poults either exposed to the bites of female mosquitoes or receiving inoculations of macerated *W. vanduzeei, C. erraticus* or *M. dyari* became infected, but 3 of 193 recipient poults that had been injected via IV or IM with an extract of *C. nigripalpus* became positive for *P. hermani.* These positive mosquitoes were trapped during September in 1977 and during August and September in 1978 (Table 2). None of the 98 poults exposed to the bites of female *C. nigripalpus* became infected.

Only 2 of 27 sentinel poults became positive for *P. hermani* during the six week period prior to and including the time of trapping the positive mosquitoes in 1977. However, in 1978, transmission among sentinel poults was more com-

[4] Actual numbers of each species collected are given in parentheses.

TABLE 2. Data on wild-caught *Culex nigripalpus* from Fisheating Creek found positive for *Plasmodium hermani.*

Recipient Poult No.	No. mosquitoes in inoculum	Route of inoculation*	Date mosquitoes trapped
1288	40	IV	Sept. 29-30, 1977
1567	75	IV	Aug. 10-11, 1978
1640	100	IM	Sept. 14-15, 1978

*IV - intravenous; IM - intramuscular.

mon; 9 of 15 sentinels exposed during August and September of that year (when positive mosquitoes were found) became positive for *P. hermani.*

These results correlate well with the experimental findings of Young *et al.*,[7] that *Culex nigripalpus* is a suitable vector of *P. hermani* in turkeys. In that study, it was reported that transmission was accomplished in 7 of 7 attempts wherein infected mosquitoes were allowed to feed on uninfected poults and in 2 of 2 poults inoculated intraperitoneally with sporozoites from the salivary glands of infected *C. nigripalpus.*

Culex nigripalpus is an opportunistic mosquito and feeds on both birds and mammals. It has been shown to feed mainly on cattle and rabbits, and ciconiiform, passeriform and galliform birds in south Florida.[1] The peak hatch of poults usually occurs during May at Fisheating Creek, although some hatching may occur in June and early July.[5,6] Although there are flying adults the year round,[1] populations of *C. nigripalpus* are largest during the summer and fall months (July to October), during which time a susceptible wild turkey poult population is present. The prevalence of *P. hermani* in this wild turkey population is high (93% in juveniles 8-12 months of age and 75% in adults over 12 months of age).[2]

In view of the above information, we feel that the demonstration of the presence of sporozoites of *P. hermani* in wild-caught *C. nigripalpus* is significant and that this mosquito is the primary vector of wild turkey malaria in Florida.

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