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SCIENTIFIC NOTE

ATTRACTIVENESS OF CHICKENS AND BOBWHITE QUAIL FOR *CULEX NIGRIPALPUS*

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ABSTRACT. An experiment to determine if wild *Culex nigripalpus* preferentially enter lard-can traps baited with chickens or bobwhite quail was conducted. A strong preference for the chicken-baited trap was observed. Further development of transmission models for St. Louis encephalitis virus in southern Florida should consider increased biting rates on sentinel chickens and the consequences for the interpretation of sentinel seroconversion data.

KEY WORDS *Culex nigripalpus,* St. Louis encephalitis, host preference, sentinel chicken, bobwhite quail

St. Louis encephalitis virus (SLE) is endemic in much of southern Florida, with transmission to sentinel chickens occurring in most years (Day and Stark 1996). *Culex nigripalpus* Theobold has been incriminated as the primary vector of SLE in southern Florida (Chamberlain et al. 1964, Dow et al. 1964, Shroyer 1991). This species feeds on a wide variety of mammals and birds, preferentially feeding on less defensive hosts in laboratory studies (Edman et al. 1974). Seasonal shifts occur in the dominant source of blood meals between birds and mammals (Edman and Taylor 1968, Edman 1974) but the shifts do not coincide with changes in host abundance (Edman 1974). This may indicate changes in host preference in the mosquito population.

Seroconversion data from sentinel chicken flocks are used in decision-making about aerial spraying and St. Louis encephalitis medical alerts. Chickens have been evaluated in laboratory preference studies (Edman 1974, Day and Edman 1984) but not in a field situation. Any bias in feeding on sentinel chickens by *Cx. nigripalpus* will affect seroconversion rates, and thus may affect decisions made based on sentinel data.

Interactions between vertebrate hosts and arthropod vectors are crucial in understanding the transmission cycle of vector-borne diseases, yet are often modeled using simple contact rates (Anderson and May 1991). Heterogeneity in host populations can affect model outcomes (Lord et al. 1996). However, data on host choice in the field are often lacking, necessitating simple assumptions about host–vector contact.

We are developing models to investigate the amplification of SLE in southern Florida. Preliminary studies with a basic transmission model (Lord, unpublished data) showed that preferences for or against sentinels affect how observed sentinel seroconversion rates reflect transmission activity in the wild bird population. This should be incorporated in future models, but necessary data are lacking. Thus, we asked the question: are *Cx. nigripalpus* preferentially attracted to chickens?

Pairs of lard-can traps (Dow et al. 1964) baited with live birds (University of Florida Animal Use Protocol VB09) were placed at 2 sites (>25 m apart) in a southern live oak (*Quercus virginiana*) and cabbage palm (*Sabal palmetto*) hammock 6.4 km SW of Vero Beach, FL. Paired traps were hung ~1 m above ground and <5 m apart, with entry holes oriented in the same direction. Baits were domestic leghorn chickens (*Gallus gallus*) or bobwhite quail (*Colinus virginianus*). Bobwhite quail were used as alternate hosts because they are hosts for *Cx. nigripalpus* in the wild (Nayar 1982), are exposed to SLE (Day and Stark 1999), and were readily available. Adult quail and 4- to 8-wk-old chickens were used to control for bird weight. Chicks and quail were weighed at the beginning and end of each week, pairs were chosen that matched to within 50 g, and the average of the 2 weights for each bird was used for analysis. Individual traps were used only for quail or chicks to prevent host odor contamination. Traps were baited and placed in the field between 1600 and 1700 h and were retrieved between 0800 and 0900 h the following morning 4 nights per week from September 22 to October 10, 1997. At site 1, 3 chick–quail pairs were used, each for 4 nights. At site 2, 2 chick–quail pairs were used, 1 for 4 nights and the 2nd pair for 8 nights. Captured mosquitoes were killed with chloroform, identified to species, and counted.

Maximum temperatures during overnight trapping ranged from 26 to 30°C, minimum temperatures ranged from 19 to 24°C, and rainfall ranged from 0 to 4.6 cm. Late afternoon and morning relative humidity ranged from 65 to 100%. Some weather variables and the date were significantly correlated (Spearman rank correlations, with the Bonferroni correction [Rice 1989] for multiple tests

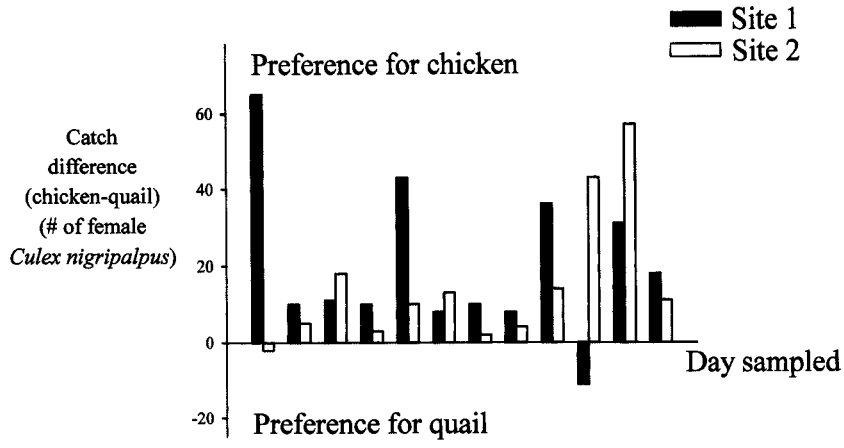

Fig. 1. Catch difference (chicken − quail) at both sites. Positive values indicate that more mosquitoes were caught in the chicken-baited trap than in the quail-baited trap.

and $\alpha = 0.05$): minimum temperature and date ($r = -0.587$), relative humidity in the morning and date ($r = 0.89$), maximum and minimum temperatures ($r = 0.594$), and maximum temperature and relative humidity in the morning ($r = 0.658$). Therefore, a subset of the variables was used in further analysis: date traps were set, maximum temperature, relative humidity in the afternoon, and rainfall overnight.

The data were normalized for the daily fluctuations in catch by subtracting the number of female *Cx. nigripalpus* caught in the quail-baited trap from the number caught in the chicken-baited trap. Repeated measures analysis of variance (ANOVA) was used to determine if the bird pairs, weather variables, date, site, or difference in bird weights affected the catch difference. Signed rank tests were used to test if the catch difference was different from zero (expected if no preference). All statistics were calculated in SAS, Proc GLM, for the ANOVA and SAS/ASSIST for signed rank tests (Statistical Analysis System, Cary, NC).

None of the variables tested affected the catch difference. Therefore, all data were combined for further analysis. More *Cx. nigripalpus* were caught in the chicken-baited traps (signed rank test, $S = 135.5$, $n = 24$, $P < 0.0005$; Fig. 1).

The relative attractiveness of chickens and other bird species is likely to vary among species, locations, or seasons. The wide host range of *Cx. nigripalpus* (Edman and Taylor 1968) suggests that females may be opportunistic and feed on the 1st host they encounter. Thus, biting rates on different species may be affected primarily by host abundance and behavior. Nonetheless, this experiment showed that *Cx. nigripalpus* is disproportionately attracted to chickens over quail of similar size.

Translating this type of experimental data into quantitative parameter estimates for models will require further research, but recognizing the existence of biases between host types is a necessary 1st step. The models considered a 2-fold increase in the biting rate on sentinel hosts; our experimental data showed an average of a 3.8-fold increase in trap catch with chickens over quail. Preliminary model results indicated that this level of preference for sentinels can result in earlier transmission to sentinels compared to wild birds. Although many questions still need to be considered empirically, host preference should be considered in transmission models being developed to investigate SLE epidemiology.

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