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OPERATIONAL NOTE

SENTINEL CHICKEN COOP MODIFICATION FOR CANOPY-LEVEL ARBOVIRUS DISEASE SURVEILLANCE

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ABSTRACT. A pulley-block system for elevating sentinel chicken coops was designed to conduct mosquito-borne virus surveillance in the forest canopy. This modified design allows traditional captive sentinel bird cages to be hoisted easily to the desired height and lowered at regular intervals for routine maintenance and sampling of the flocks. The design specifications of this canopy system are modifications that can easily be incorporated to existing rabbit hutches used in ground-level captive sentinel systems.

KEY WORDS Sentinel chicken, canopy surveillance, vector control program, mosquito-borne virus

The use of captive sentinel birds in vector control programs can provide accurate assessment of the epizootic and epidemic risk as posed by certain arboviruses (Komar 2001). For example, sentinel chicken flocks have been an important tool in understanding the epidemiology of St. Louis encephalitis in Florida (Day et al. 1985). Domestic chickens are preferable candidates for captive sentinel surveillance as they are generally disease resistant and uniformly susceptible to infection, develop a detectable immune response, and are unlikely to infect the vector population (Reisen et al. 1994, Komar 2001). Furthermore, chickens are easily handled and maintained, represent a readily available sentinel to numerous vector surveillance programs, and have the potential as a standard for cross-region comparison of pathogen transmission dynamics and control efforts.

Captive avian surveillance is intended to monitor the prevalence of a pathogen in time/place and provide an advance warning for potential outbreaks of disease. Seroconversion rates in sentinel chickens have been used as one of the main methods to assess risk and determine control efforts for several arbovirus surveillance programs in the USA (Day et al. 1985, Barker et al. 2003). Placement of the captive sentinels is the most critical aspect of this type of surveillance (Day et al. 1985, Komar 2001). Since various studies show a greater prevalence of infected vectors at higher elevations than at ground level in certain regions (Anderson et al. 2004, Savage et al. 2008), it may be important for an effective surveillance program to monitor seroconversions both on the ground and in the canopy. Chicken-baited traps in the canopy can catch females of enzootic *Culex* vectors of several arboviruses at a 6- to 10-fold higher frequency than the same traps at ground level (Main et al. 1966), further suggesting the potential utility of elevated sentinel chicken surveillance. Moreover, Deegan et al. (2005), in a single study to investigate sentinel seroconversions in the canopy, found significantly more seropositive chickens detected in the canopy than at ground level. Here we describe a method for easily elevating standard avian surveillance cages, designed and fabricated for canopy-level use in a vector control program.

A standard caging strategy for captive sentinel surveillance (Komar 2001) was utilized for this purpose. We obtained commercially available rabbit hutches from Agway® (New Brunswick, NJ). The standard hutches include a 4 ft (1.2 m) long by 3 ft (0.9 m) wide by 1½ ft (0.5 m) high wire pen attached to a 3 ft (0.9 m) wide by 2 ft (0.6 m) deep by 2 ft (0.6 m) high coop. The coop is bolted to the pen and fitted with legs that raise the entire structure 3 ft (0.9 m) off the ground, although these legs were cut to 11-in. (28-cm) lengths as part of our modification. Food is dispensed through a J-feeder container and a beak-triggered watering device is attached to a 5-gal (19-liter) pail on top of the coop. Food and water are provided in the wire mesh area of the cage, thus providing more exposure of chickens to mosquitoes. The hutches also provide a sheltered enclosed area to protect chickens from the elements and provide an area with wood shavings for egg laying. The above described hutches may comfortably house 3 adult chickens for a sentinel surveillance program.

A 39-in. (99-cm) plank of 2 × 6-in. (5 × 15-cm) lumber was nailed onto the underside of the cage's framework on each side of its face for structural support, so that it extended 6½ in. (16.5 cm) out from the width of the cage on both sides (Fig. 1). Large eye bolts (⅜ × 6 in.) were drilled into both sides of each plank, 2 in. (5.1 cm) from the end, and a supporting 2 × 6-

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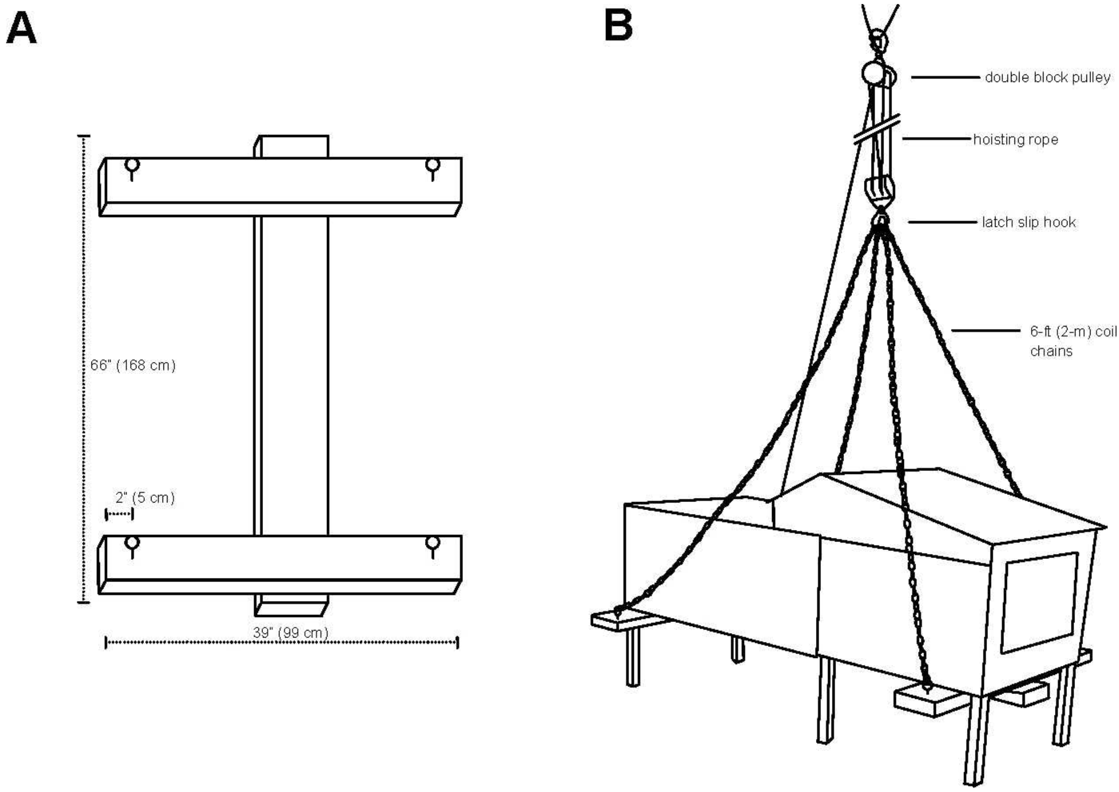

Fig. 1. Diagram detailing elevating system design for canopy-level sentinel chicken surveillance. (A) Top-down view of supporting modifications to cage underside. (B) View of set system for elevation.

Fig. 2. (A) Elevating system for sentinel chicken surveillance in the canopy. (B) Enlarged view in canopy.

in. (5 × 15-cm) board (66-in. or 168-cm) was nailed across the length of the cage underneath these two planks. A ⅜-in. latch slip hook joined four 6-ft (1.8-m) lengths of ¼-in. grade 30 coil chains to a 2-in. (5-cm) double pulley block (WLL 1,000 lb, Campbell® 3102F, CooperTools, Apex, NC), which was then attached to a 100-ft (30.5-m) length of ⅝-in. (1.6-cm) braided rope. To set and elevate the cage, the ends of each chain were fitted into each eye bolt, the rope was fitted through a second fixed double pulley block that was secured to a branch of suitable strength in the canopy, and two 65-ft (20-m) ⅜-in. (1-cm) stabilizing nylon ropes were attached to the board between the supporting 2 × 6-in. (5 × 15-cm) struts to prevent twisting and spinning of the cage (Fig. 2). Once elevated, the hoisting and stabilizing ropes were secured at ground level to an appropriate structure, such as a nearby tree trunk. Apart from the double-block pulleys, all of the above materials may readily be purchased from nationwide hardware stores.

A method to easily hoist standard chicken coops allows for sentinel surveillance in the canopy, which may be particularly important in certain regions, such as the northeastern USA, where the main enzootic vectors host-seek primarily in the canopy (Anderson et al. 2004, Farajollahi et al. 2005, Andreadis and Armstrong 2007). This strategy could improve the sensitivity of a sentinel program by increasing the frequency of contact between a sentinel and the primary enzootic mosquito vectors. The primary location of the enzootic cycle may occur in the canopy, which could account for the fact that previous ground-based sentinel surveillance has failed to predict epidemic or epizootic outbreaks (Crans 1986). Through the reinforcement of commercially available chicken coops and a means to elevate them, we have described a simplified method of conducting sentinel surveillance using captive chickens in the canopy. This strategy permits the use of ground-based and canopy-level surveillance to efficiently target enzootic transmission sites and optimize response for control efforts. Furthermore, after initial setup, the pulley system eliminates safety risks associated with climbing to heights of 15–30 ft (5–9 m) and ensures ease of access to the flocks for maintenance and blood sampling. The ability to detect increased incidence of pathogen activity early and in specific locations is fundamental to effective vector control programs. Captive sentinel surveillance offers specific time and place information of transmission events and can be the first indication of such activity. This design adapts a long-standing and cost-efficient predictive method of measuring the epidemic and epizootic spread of certain mosquito-borne diseases. It is possible that increasing the efficiency of sentinel chicken surveillance through placement where the highest levels of enzootic transmission occur may significantly improve the sensitivity of detection and potentially streamline control efforts to more effectively predict and prevent disease outbreaks.

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