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A simple method for restraint of small mammals for sampling blood or tissue in the field

JOHN L. ORROCK[1,*]

[1]*Department of Integrative Biology, University of Wisconsin, Madison, WI 53706*

ABSTRACT.—Because wild rodents often harbor zoonotic pathogens that can be transmitted via saliva, urine, or feces (e.g., hantaviruses), researchers can be at risk when collecting rodent blood or tissue samples that are required for innumerable assays (e.g., infection status, hormone assays, etc.). I describe how inexpensive, readily available 50-mL centrifuge tubes can be easily modified to create a handling tube for the safe restraint of small rodents while a blood and/or tissue sample is collected from the tail. This approach has been used to successfully sample thousands of deer mice (*Peromyscus maniculatus*), the primary host for Sin Nombre virus, a zoonotic disease that is pathogenic for humans.

RESUMEN.—Debido a que los roedores silvestres frecuntemente son portadores de patógenos zoonóticos que pueden transmitirse a través de la saliva, la orina o las heces (e.g., hantavirus), los investigadores pueden correr riesgo al recolectar las muestras de sangre o tejido de roedores necesarias para realizar un gran número de estudios (estado de infección, pruebas hormonales, etc.). A continuación, describo cómo los tubos de centrífuga de 50 mL, que son económicos y ampliamente disponibles, se pueden modificar fácilmente para crear un tubo de manipulación para sujetar de manera segura a pequeños roedores mientras se extrae una muestra de sangre y/o tejido de la cola. Este método se ha utilizado para muestrear con éxito miles de ratones ciervo (*Peromyscus maniculatus*), el principal portador del virus "Sin Nombre", una enfermedad zoonótica patógena para los humanos.

Assessing the health and disease status of wild animals often requires obtaining a blood and/or tissue sample. For example, wild rodents are often important hosts of infectious agents that cause a number of zoonotic diseases, such as Sin Nombre virus, plague, and Lyme disease (Han et al. 2015). In addition, blood samples can be useful for ascertaining an animal's stress or reproductive status (e.g., glucocorticoid levels), and tissue samples may be used to understand an animal's diet (e.g., via analysis of stable isotopes) as well as evaluate molecular or genetic hypotheses. Obtaining blood or tissue samples from mice in the field also carries risks to researchers, as individuals may be bitten by a mouse that is infected with pathogenic agents that can be transmitted to humans (e.g., hantaviruses such as Sin Nombre virus; Forbes et al. 2018). I present a simple method for field restraint of small rodents that has the benefit of reducing the likelihood that a researcher will be bitten, scratched, or exposed to excreta while sampling small rodents.

The method uses handling tubes constructed from plastic 50-mL centrifuge tubes (Fig. 1), which are inexpensive and widely available. The tube is modified by drilling 4 to 5 small holes (approximately 2 mm in diameter) into the tapered end of the tube to provide ventilation (Fig. 1A). Small-mammal researchers often empty animals from live traps into a plastic or cloth handling bag to initiate processing (Jones et al. 1996). The tube is placed within the handling bag, and rodents typically enter the tube with little hesitation. They move headfirst to the tapered end of the tube, which positions their tail at the open end of the tube (Fig. 1B). Alternatively, if an animal is to be marked (e.g., with an ear tag) or if morphological measurements are needed, it can first be restrained (i.e., "scruffed") through the handling bag and then introduced into the tube. Once in the tube, the animal can be removed from the bag and weighed (Fig. 1B). The tail of the animal is accessible, allowing the researcher to take a

*Corresponding author: jorrock@wisc.edu

JLO orcid.org/0000-0003-0768-7389

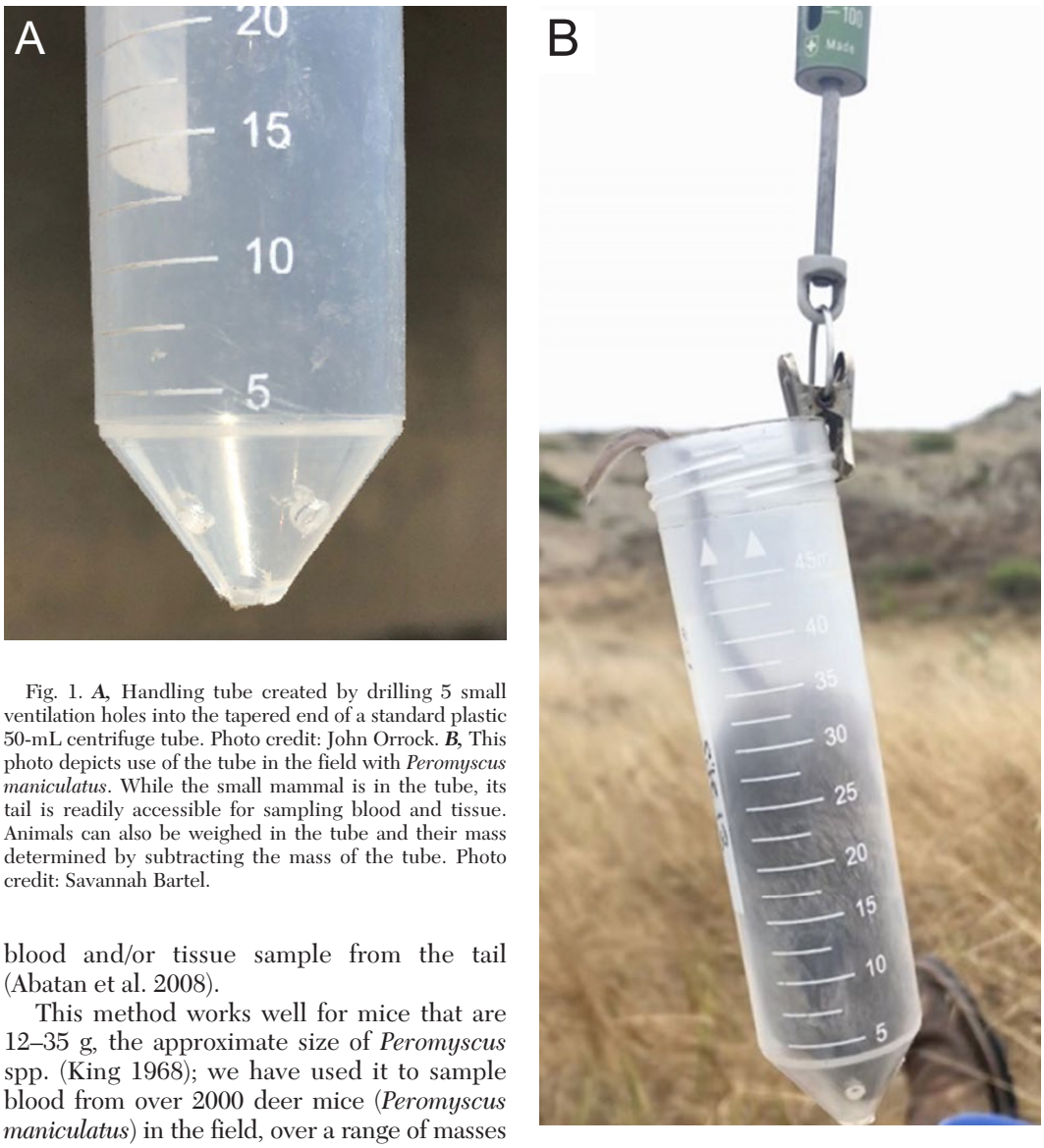

Fig. 1. ***A,*** Handling tube created by drilling 5 small ventilation holes into the tapered end of a standard plastic 50-mL centrifuge tube. Photo credit: John Orrock. ***B,*** This photo depicts use of the tube in the field with *Peromyscus maniculatus*. While the small mammal is in the tube, its tail is readily accessible for sampling blood and tissue. Animals can also be weighed in the tube and their mass determined by subtracting the mass of the tube. Photo credit: Savannah Bartel.

blood and/or tissue sample from the tail (Abatan et al. 2008).

This method works well for mice that are 12–35 g, the approximate size of *Peromyscus* spp. (King 1968); we have used it to sample blood from over 2000 deer mice (*Peromyscus maniculatus*) in the field, over a range of masses from 9 g to 36 g. This method of restraint is not compatible with techniques for taking blood samples from the anterior portion of the animal, such as from the retro-orbital sinus or the submandibular region. In addition to providing a safe method of handling while a blood or tissue sample is being taken from the tail, this method may also be useful for sampling ectoparasites, as fleas may become dislodged from the tail while a blood sample is being taken (personal observation). Animal mass can also be measured while the mouse is in the tube (Fig. 1B). Age, gender, and reproductive status can be assessed while the animal is entering or exiting the tube. For example, the gender and reproductive status can be determined by gently pulling the tail to remove the posterior portion of the animal from the tube. Once this is completed, the animal can be released by gently pulling the tail until the animal is completely free of the tube. After use, the tube can be readily cleaned using standard disinfectants, or a fresh tube can be used if desired.

Mammals smaller than *Peromyscus* spp. may still be handled using the tube described here, although more care must be taken because smaller animals may be capable of turning around while in the tube. We have observed this

turning motion when using the handling tube with western harvest mice (*Reithrodontomys megalotis*), for example. Smaller variants of this tube may be most useful for smaller species, whereas larger tubes (e.g., constructed from clear plastic tubing with a ventilated end cap) could be useful for larger species, such as rats. Given the importance of *Peromyscus* spp. as vectors of important zoonotic disease agents (Yates et al. 2002, Han et al. 2015), and their widespread distribution across North America (King 1968), this technique provides a simple, inexpensive means for researchers working on rodents of these species to more safely sample animals in the field. Because rodents of many species are also of this same approximate size (e.g., *Mus musculus*, *Microtus* spp., *Myodes* spp.), and because these species may also harbor zoonotic diseases (Yates et al. 2002, Han et al. 2015), this method may be applicable in many field situations where researchers wish to sample blood and/or tissue while minimizing the likelihood of being bitten.

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