FIRST RECORD OF *CUTEREBRA FONTINELLA* (DIPTERA: OESTRIDAE) LARVAE INFESTING A FLORIDA RAT (RODENTIA: MURIDAE)

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The host relationships of *Cuterebra* spp. bot flies (Diptera: Oestridae) are of interest from both the perspective of parasite/host coevolution (Colwell et al. 2006; Slansky 2007a) and the context of these insects causing a type of myiasis (cuterebrosis) in cats, dogs, humans, and other mammals (Safdar et al. 2003; Slansky 2007b,c; 2008). *Cuterebra* spp. larvae typically parasitize either indigenous lagomorphs (rabbits and hares) or rodents (e.g., mice, rats and tree squirrels) in the Americas (Sabrosky 1986; Slansky & Kenyon 2003), with each generally restricted to one or a few closely related host species. Occasionally they infest other mammals ('atypical' hosts; Sabrosky 1986; Slansky & Huckabee 2006; Slansky 2007b,c; Slansky 2008). Whether the latter represent aberrant cases, as categorized by Sabrosky (1986), or reflect incipient broadening of the host spectrum of these flies, is uncertain. Thus, studies are required to help define these flies' host relationships. Here we describe an unusual case of an eastern woodrat, *Neotoma floridana* (Ord) (Rodentia: Muridae), parasitized by larvae of *Cuterebra fontinella* Clark, which typically infest mice.

In late Apr 2007, a severely emaciated rat in Sebastian, Indian River county, Florida, was killed in a suburban area adjacent to a 0.3 ha plot of dense scrub, including Brazilian pepper (*Schinus terebinthifolius* Raddi, palmetto (*Sabal* spp. and *Serenoa repens* (Bartr.) Small, oak (*Quercus* spp.) and pine (*Pinus* spp.). Upon the animal's death, 5 larvae emerged from its lower abdomen, leaving large holes that exposed the underlying muscle fascia. Four larvae were placed in a glass jar with vented lid containing moist sandy soil, and a thin layer of soil was sprinkled over them. The jar was kept in a shaded area outdoors for approximately 3 weeks, after which it was maintained indoors at approximately 21-24°C; 2 female flies eventually emerged, 1 in late Jun and the other in early Jul, 2007. Subsequently, they died and were pinned for preservation. One larva was preserved in isopropanol. These specimens are deposited in the Medical & Veterinary Insect Collection, Department of Entomology & Nematology, at the University of Florida, Gainesville, as voucher specimens UF070501, UF070502 and UF070503, respectively. The first fly was photographed with a Nikon® model D200 digital camera, and images of the larva were made with an Automontage® digital photomicroscopy system (Synchroscopy, Frederick, Maryland). The rat was tentatively identified as an eastern woodrat but the specimen was not retained. Another rat was therefore collected from the same population and confirmed to be *N. floridana*; it is deposited as voucher specimen UF 31368 in the mammal collection of the Florida Museum of Natural History at the University of Florida, Gainesville.

Based upon information in Sabrosky (1986), the flies (Fig. 1a,b) were determined to be *C. fontinella*. The larva (Fig. 1c) appears to have partially pupariated. Some of the mostly flattened, exterior platelets are raised slightly and have multiple points (Fig. 1d), a characteristic of third instars of rodent-infesting *Cuterebra* species; in contrast, lagomorph-infesting species have cone-shaped spine-like platelets (Slansky & Huckabee 2006; Slansky 2007b). The lack of 2 button-like anterior spiracles typically extruded by *Cuterebra* spp. larvae during pupariation (Sabrosky 1986; Slansky & Kenyon 2003) indicates this process was incomplete. The pupal durations and dates of emergence for these specimens support records indicating that *C. fontinella* has 2 or more generations per year in the southeastern US (Sabrosky 1986; Durden 1995, 2008; Slansky 2006). This species apparently has not been reported previously from Indian River County, although there are records from other eastern counties north (Orange and Volusia) and south (Broward and St. Lucie) of this county (Slansky 2006).

Only 2 published studies have reported *Cuterebra* spp. infesting *N. floridana* in Florida, and in neither was the species of *Cuterebra* identified (Johnson 1930; Worth 1950a). Outside Florida, only *Cuterebra americana* (Fabricius) has been reared from *N. floridana* (Sabrosky 1986; L. A. Durden, personal communication to F. S.). Thus, the case described here appears to be the first confirmed report of a *Cuterebra* species other than *C. americana*, and of *C. fontinella*, reared from *N. floridana*. This appears to be the first published, substantiated record for Florida of a *Cuterebra* species reared from any of the 3 indigenous rat species (*N. floridana*, the rice rat, *Oryzomys palustris* (Harlan) and the hispid cotton rat, *Sigmodon hispidus* Say and Ord) or 2 non-indigenous

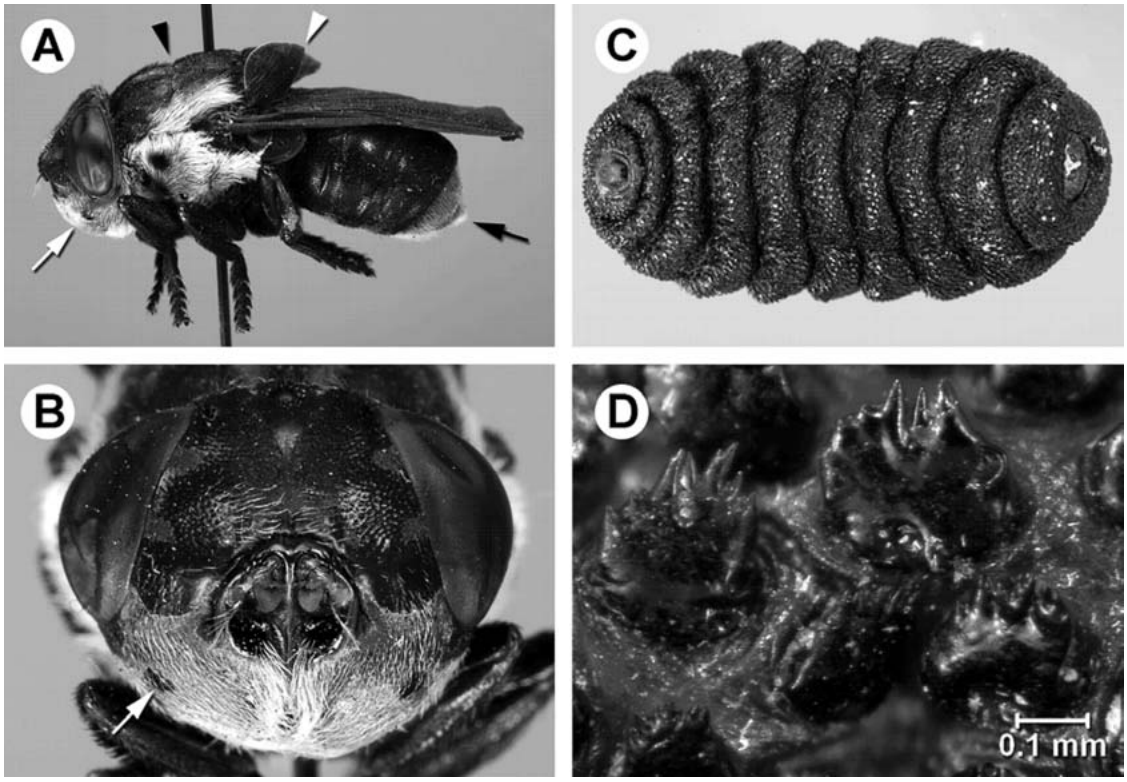

Fig. 1. *Cuterebra fontinella* specimens resulting from larvae infesting an eastern woodrat, *Neotoma floridana*, in Indian River Co., Florida. (A) Adult female (lateral view; 18 mm long from head to tip of abdomen; the other fly, also a female (not shown) is 16 mm long); some key characteristics of this species include the dense whitish pubescence with black genal spots on the lower half of the head (white arrow), black-haired mesoscutum (black arrowhead) and scutellum (white arrowhead), and yellowish white pubescence on the fifth abdominal tergite (black arrow). (B) Head of specimen in (A) (width= 7.4 mm; 7.2 mm in the fly not shown); white arrow indicates 1 of the 2 black genal spots within the dense whitish pubescence on the lower half of the head. (C) Third instar/ partial puparium covered with cuticular platelets (ventral view; anterior to left; 18 mm long). (D) Multipoint cuticular platelets on the specimen in (C) are characteristic of larvae of *C. fontinella* and other rodent-infesting *Cuterebra* species.

Rattus species (the black rat, *R. rattus* (L.) and the Norway rat, *R. norvegicus* (Berkenhout)) in the state and identified to species. Worth (1950b,c) captured individuals of both *Rattus* species in Dade and Hillsborough counties in Florida, and only some of the *R. rattus* showed evidence of *Cuterebra* spp. parasitism. Sabrosky (1986; p. 161) cited Worth (1950b,c) as having reared *C. americana* from *R. rattus* captured in Hillsborough county, but we found no mention of this in either of these papers; in fact, Worth (1950b) stated that no *Cuterebra* spp. larvae in his studies were successfully reared to adults, so perhaps Sabrosky's statement reflects a subsequent personal communication from Worth or is inaccurate. More recently, an adult of (possibly *C. fontinella*) was reared from an individual *R. rattus* collected in Bay Co., Florida in 2005 (L. A. Durden, personal communication to F. S.). Elsewhere, *C. americana* has been reared only from *N. floridana* (and possibly from an unidentified rabbit; Sabrosky 1986).

In Florida, the primary hosts of *C. fontinella* are probably the cotton mouse, *Peromyscus gossypinus* (LeConte), golden mouse, *Ochrotomys nuttalli* (Harlan) and Florida mouse, *Podomys floridanus* (Chapman) (Pearson 1954; Layne 1963; Bigler & Jenkins 1975). While it is likely that these mice were parasitized by *C. fontinella* (the only known mouse-specialist *Cuterebra* species in Florida), in none of these studies was the species of *Cuterebra* identified. Outside Florida, *C. fontinella* has been reported from the first two species listed above and from several other indigenous and exotic rodent species (Sabrosky 1986; Durden 1995; 2008; Clark & Durden 2002; L. A. Durden, personal communication to F. S.). A *C. fontinella* larva was found infesting the raccoon, *Procyon lotor* (L.) in Florida (Slansky & Huckabee 2006). The emaciated condition of the infested rat involved here likely was caused by the 5 larvae parasitizing it and by the presumed 'atypical' nature of this encounter; 1-3 *Cuterebra* spp. larvae

commonly occur per individual host and these generally exert little apparent impact on their typical hosts (Slansky 2007a).

Our finding of larvae of the mouse-specialist *C. fontinella* parasitizing a woodrat indicates that one cannot assume that bot fly larvae infesting field-trapped individuals of *N. floridana* (e.g., Johnson 1930; Worth 1950a; Clark & Durden 2002) are *C. americana*, their typical *Cuterebra* spp. parasite. Specimens from such hosts must be identified to species. Additional studies are required to evaluate the extent to which individuals of *N. floridana* serve as hosts for larvae of *C. fontinella* and whether such occurrences are ecologically relevant.

We thank Susan L. Bailey for collecting the larvae, identifying the parasitized woodrat, and collecting and preserving the second woodrat specimen, Lois Wood for keying out the adult flies, Lyle Buss for photography, and Jane Medley for image processing and layout. In addition, we are grateful to Candace McCaffery, Mammals Collection Manager, Florida Museum of Natural History, for confirming our identification of the species of rat involved in this case.

SUMMARY

Two flies obtained from larvae infesting an eastern woodrat (*Neotoma floridana*) in Indian River County, Florida, are identified as *Cuterebra fontinella*, a species that typically parasitizes various species of mice. This appears to be the first published, substantiated report of a *Cuterebra* species other than *C. americana* reared from *N. floridana* and identified to species, and of *C. fontinella* from this county.

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