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Scientific Notes

Discovery and successful development of *Cuterebra americana* (Diptera: Oestridae) from an atypical host, *Rattus rattus* (Rodentia: Muridae), in Florida, U.S.A.

Phillip E. Kaufman and Lois A. Wood*

Bot flies (Diptera: Oestridae) are obligate parasites of vertebrates that have coevolved with their hosts to form a physiological relationship that is minimally harmful to the host and protective of the parasitic larva (Scholl et al. 2009). The predominant hosts of the subfamily, Cuterebrinae, are rodents and lagomorphs. Typically, a species of bot fly is associated with one or a few related hosts (Catts 1982; Sabrosky 1986; Slansky 2006), but exceptions are not unknown. Rodent bot flies have been recorded infecting and producing adults from rodent spe-

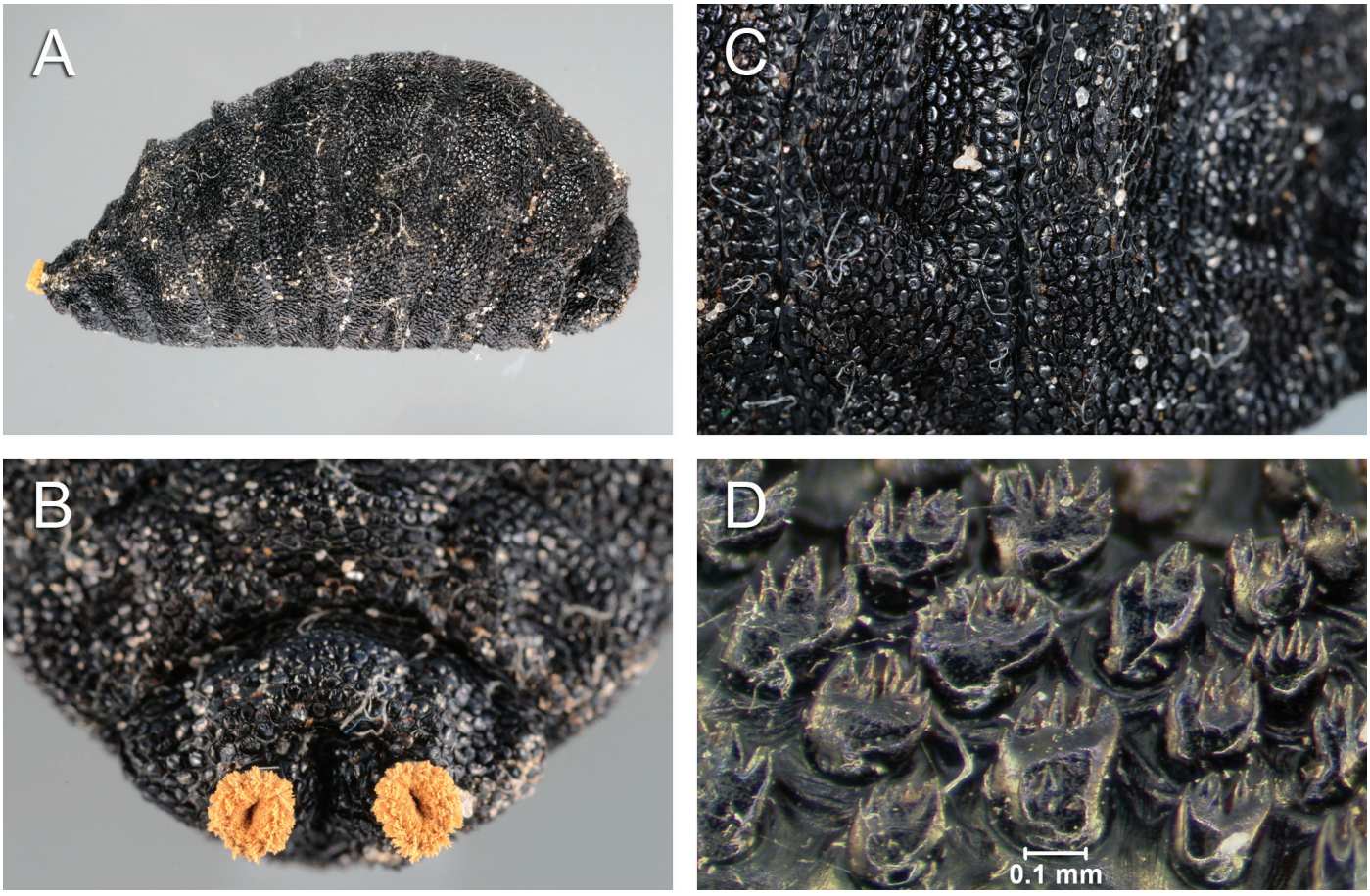


Fig. 1. Puparium of *Cuterebra americana* (Fabricius), A) puparium in profile, 24 × 13 × 12 mm l × w × h; B) extruded, yellow, elliptical anterior spiracles with subtriangular operculum on the tergum of segments 1 to 3; C) spines on surface of puparium; and D) magnified plate-like, multi-pointed spines. This figure is displayed in color in the online version of this article.

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cies other than their usual host (Slansky et al. 2008). Bot flies have been observed to infect even more atypical hosts (cats, dogs, raccoons, horses, humans), but the development of the larvae in these cases is not always successful (Slansky 2007).

On 24 May 2012, a Gainesville, Florida homeowner encountered a rodent in his garden behaving strangely, seemingly groggy. The homeowner stated that after the rodent was killed, a large dark brown bot larva was in the process of exiting through a hole in the skin in the neck area. After 15-20 min, a second bot larva emerged. The homeowner believed one had died and froze it with the rodent carcass. The other was placed in a jar with damp sand. The bot larvae and rodent were given to the University of Florida. The live larva pupated on 29 May 2012 and was held in the veterinary entomology laboratory in an incubator operated at 25 °C and 75% RH (Fig. 1).

On 21 Sep 2012, a dead adult fly was discovered in the holding chamber, 115 days after pupation and within 14 days of the previous observation. The fly was identified as a female woodrat bot fly, *Cuterebra americana* (F.) (Diptera: Oestridae) and has been deposited in the Veterinary Insect Collection, Entomology and Nematology Department, at the University of Florida, Gainesville, as voucher specimen UF091201 (Fig. 2). The host was a non-native roof rat, *Rattus rattus* (L.) (Rodentia: Muridae) with identification confirmed by mammalogist, Candace McCaffery at the Florida Museum of Natural History, and has been deposited as voucher specimen UF32300 in the mammal collection of the Museum at the University of Florida, Gainesville. According to McCaffery, the rat had three bot fly larva exit holes in its neck area, and the rat's carotid artery was visible through one of the holes. The frozen bot was undergoing pupariation when placed in the freezer and was placed in the Veterinary Insect Collection (voucher specimen UF091202). So, although the rat had three exit holes, we only have two bot specimens.

The host of predilection for *C. americana* is the eastern woodrat, or pack rat, *Neotoma floridana* (Ord) (Rodentia: Muridae). Typically, the natural host of a bot infestation is minimally impacted by the demands of the parasite. The usual site of *C. americana* warbles on its natural host is between the front legs (Beamer et al. 1943; this citation refers to *Cuterebra beameri* Hall, which was a misidentified *C. americana*). While most of the Beamer et al. (1943) study animals had just one larva, one rat had five, three of which produced adults. Their observations of the remarkable cleanliness of warble sites, the animals' apathy toward the warbles and the rapid closure and disappearance of the wounds after larval emergence attest to the physiological adaptations of this parasitic relationship.

In contrast, the observations by the mammalogist who processed the roof rat carcass included that the exit holes in the neck exposed the carotid artery, and that the bots had generated considerable tissue damage. Injury notwithstanding, the impact of the parasitism was likely more of a strain on this non-native, atypical host species. Atypical host infestations have been reported for many bot species, but typically the bots do not complete development. Incidence of an eastern woodrat being successfully parasitized by *C. fontinella,* typically a parasite of mice in the genus *Peromyscus,* was reported by Slansky et al. (2008). In that case, the woodrat was severely emaciated and when it died, five larvae emerged from its lower abdomen. Two of those produced adults. This is the same body region in which *C. fontinella* typically develops on its mouse hosts. In the case of the eastern woodrat, however, the exit holes were so large, they exposed the underlying muscle fascia, perhaps increasing physiological stress from the atypical parasite.

Beamer et al. (1943) reported successful adult *C. americana* emergence for two consecutive years from local (Kansas) eastern woodrats and the emergence dates were in late Aug through Sep. Believing that this *Cuterebra* species must have two generations a year, the authors examined over 50 woodrat nests in late Sep, looking for rats with warbles. Out of 45 woodrats examined, five were parasitized by a total of six cuterebrid larvae. The larvae emerged from hosts in Oct, but no adults had appeared by the following Mar. It is probable that the pupae entered winter diapause. Various factors (*Cuterebra* species, temperature, humidity, day length) can affect pupal duration (Catts 1982). Thus the time period of larval and adult fly emergence in the present case is in general agreement with the observations in Kansas. Perhaps the longer pupation time is a function of the longer day length or warmer Florida climate, although it could have been affected by the biology of the non-native host. Whether Florida could support 2 or more generations a year is a topic for further research, albeit difficult with these rarely encountered flies.

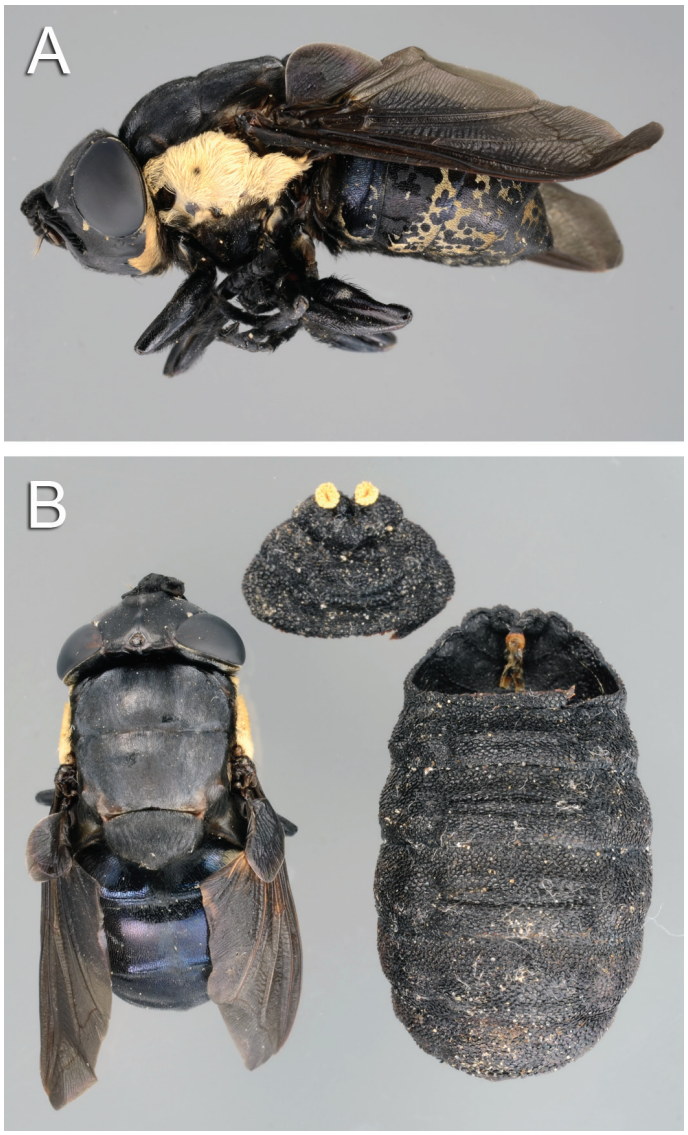


Fig. 2. Adult female *Cuterebra americana* (Fabricius) (25 mm long) and emerged adult alongside puparium and operculum. This figure is displayed in color in the online version of this article.

Cuterebrid eggs are laid on sticks, stones or other surfaces at or near the entrance to woodrat nests (Beamer et al. 1943). This roof rat may have acquired its larval infestation from its own nest, in which case the bot fly had mistakenly selected an oviposition site. Alternatively, the fly could have laid her eggs near a *N. floridana* nest that the roof rat had either usurped or investigated.

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Cuterebra americana purportedly has been recorded from *R. rattus* in Florida and Georgia (Sabrosky 1986), but the citations of the Florida studies (Worth 1950a,b) do not include an identification of the species of *Cuterebra*, and there is no reference provided for the Georgia record. Thus this is the first documented occurrence of *C. americana* successfully emerging from the non-native, atypical host, *R. rattus*.

We thank Richard Ogden for collecting the rat and larvae, Lyle Buss for photography and Candace McCaffery for confirming the species of rat involved in this case.

Summary

We provide the first documented occurrence of the woodrat bot fly, *Cuterebra americana* successfully completing larval development from the roof rat, *Rattus rattus*. We also document the pupal development time and atypical host damage from this infestation.

Key Words: bot fly, eastern woodrat, obligate parasite, *Neotoma floridana,* pack rat

Sumario

Se documenta la primera aparición documentada de la mosca de tórsalo de la rata de madera*, Cuterebra americana* en completar su desarrollo larval con éxito en la rata de los tejados, *Rattus rattus.* Ademas, documentamos el tiempo de desarrollo de pupa y daño atípico al hospedero de esta infestación.

Palabras Clave: mosca de tórsalo, rata oriental de madera, parásito obligado, *Neotoma floridana,* rata empacadora

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