Journal of Mammalogy, 97(2):568–575, 2016
DOI:10.1093/jmammal/gyv203

Observations on the behavior of *Caenolestes fuliginosus* (Tomes, 1863) (Marsupialia, Paucituberculata, Caenolestidae) in captivity

Gabriel M. Martin* and Baltazar González-Chávez

Centro de Investigaciones Esquel de Montaña y Estepa Patagónica (CIEMEP), Roca 780, CP 9200, Esquel, Chubut, Argentina (GMM)
Universidad del Valle, Apartado Aereo 25360, Cali, Colombia, Colombia (BG-C)

* *Correspondent: gmartin_ar@yahoo.com*

We describe the behavior in captivity of the dusky shrew-opossum *Caenolestes fuliginosus* from 17 specimens captured at Finca La Martinica (Colombia), which were kept alive in plastic terraria for different periods of time (between 1 and 12 consecutive days). We found that *C. fuliginosus* can climb and jump well and uses its nonprehensile tail as a support when climbing. Feeding observations showed a preference towards an animalivorous diet, which included moths/butterflies (Insecta, Lepidoptera), stick-insects (Insecta, Phasmatoidea), flatworms (Platyhelminthes, Turbellaria), earthworms (Annelida, Oligochaeta), frogs (Amphibia, e.g., *Pristimantis* sp.), and dead rodents (Rodentia, Sigmodontinae, e.g., *Microryzomys* sp., *Thomasomys* sp.). Individuals were active throughout the day and night, with no indication of daily torpor. Our observations showed *C. fuliginosus* is not aggressive towards congeners and often aggregates during rest, especially when several individuals are placed together. Unlike other New World marsupials, *C. fuliginosus* showed nonagonistic group feeding behavior when consuming carcasses. Stereotyped behavior patterns (e.g., grooming) were not frequently observed. Our work provides comparative information for further studies on caenolestids and other New World marsupials.

En este trabajo describimos el comportamiento en cautiverio del ratón Runcho, *Caenolestes fuliginosus,* a partir de la observación directa de 17 individuos capturados en Finca La Martinica (Colombia), que fueron mantenidos en terrarios plásticos por diferentes períodos de tiempo (entre 1 y 12 días consecutivos). Observamos que *C. fuliginosus* puede trepar y saltar bien, usando su cola no prensil como soporte al trepar. Los individuos mostraron preferencias alimenticias hacia una dieta animalívora que incluyó: polillas/mariposas (Insecta, Lepidoptera), insectos palo (Insecta, Phasmatoidea), gusanos planos de vida libre (Platyhelminthes, Turbellaria), lombrices (Annelida, Oligochaeta), ranas/sapos (Amphibia, e.g., *Pristimantis* sp.) y roedores muertos (Rodentia, Sigmodontinae, e.g., *Microryzomys* sp., *Thomasomys* sp.). Observamos actividad durante todo el día y la noche, sin preferencias, y no observamos torpor en ningún individuo. Los individuos no mostraron comportamiento agresivo hacia sus congéneres y, con frecuencia, se juntaron para descansar unos sobre otros. A diferencia de otros marsupiales del nuevo mundo, *C. fuliginosus* no mostró comportamiento agonístico cuando se alimenta de cadáveres. Patrones estereotipados de comportamiento (e.g., limpieza) no fueron frecuentemente observados. Nuestro trabajo aporta información comparativa para futuros estudios sobre el comportamiento de otros cenoléstidos y marsupiales del nuevo mundo.

Key words: behavior, feeding preferences, locomotion, New World marsupials, shrew-opossums

Behavioral studies on New World marsupials are limited to a few species, mostly within the species-rich family Didelphidae (e.g., *Didelphis virginiana*, McManus 1970; *Monodelphis domestica* and *Didelphis albiventris*, Streilein 1982; *Monodelphis dimidiata*, González and Claramunt 2000; *Lestodelphys halli*, Martin and Udrizar Sauthier 2011). Anecdotal information is also available for some species (e.g., Bruch 1917; McManus 1970), but many that live in extreme habitats (i.e., those with higher energy demands, either for species with a low metabolic rate like most marsupials, or other small-sized mammals) (see below) remain unstudied (e.g., caenolestids and other high altitude marsupial species like *Thylamys pallidior*). Comparative studies are also lacking, which would be important to form hypothesis about marsupial adaptations to different environments and could shed light on how behavioral patterns have evolved throughout this group (McManus 1970; Martin and Bateson 1993; González and Claramunt 2000; Martin and Udrizar Sauthier 2011).

So far, studies show New World marsupials often exhibit generally stereotyped behavior, including exploration, prey manipulation, grooming, and other socially related behavior (Bruch 1917; Mann 1955; Hershkovitz 1997; Palma 1997; González and Claramunt 2000; Martin 2008; Martin and Udrizar Sauthier 2011; Dalloz et al. 2012).

Among New World marsupials, the behavior and ecology of shrew-opossums of the family Caenolestidae (order Paucituberculata) are poorly known (Timm and Patterson 2008). Caenolestids are restricted to South America and are the only living representatives of the once-diverse order Paucituberculata, which includes several specialized forms that had their maximum richness during the Middle Tertiary (Abello 2007, 2013). This family includes 3 genera of marsupials with a disjunct distribution along the Andes (Patterson 2008; Martin 2013): *Caenolestes*, ranging from northeastern Colombia–western Venezuela to northwestern Perú; *Lestoros*, ranging from southern Perú to western Bolivia; and *Rhyncholestes*, from the south-central portion of Chile, Chiloé Island and one locality in Argentina (Martin 2008; Patterson 2008; Martin 2011, 2013).

Although aspects of the natural history of caenolestids have been described in some detail (e.g., Kirsch and Waller 1979), information for most species is scarce, coming from just a few specimens kept for very short periods of time. The Dusky shrew-opossum *C. fuliginosus* Tomes lives in high Andean rainforest (selva altoandina sensu Cavelier et al. 2001), subpáramos and páramos from central Ecuador to Colombia's Cordillera Central, at elevations above 2,150 m (Timm and Patterson 2008; Patterson 2015). It is regarded as the smallest species of the genus *Caenolestes* (Patterson 2015) and probably part of a different subgenus (Anthony 1924; but see Ojala-Barbour et al. 2013).

New World marsupials live in very diverse habitats ranging from perhumid to xeric environments, their diversity is highest at intermediate latitudes (Birney and Monjeau 2003; Martin 2012). High-elevation Andean environments where *C. fuliginosus* lives in are very different from the "typical" habitat in which New World marsupials thrive. Therefore, *C. fuliginosus* represents an interesting study case due to its distribution in high-altitude extreme environments (Timm and Patterson 2008). Two main adaptations are present in marsupials living in seasonal and/or extreme environments: the ability to enter torpor and/or hibernation and tail-fat storage (Morton 1980; Tyndale-Biscoe 2005), as a means to preserve energy (Morton 1980; Geiser 1994). No information is available for *Caenolestes* spp. in this respect.

The main objective of our contribution is to describe the behavior of *C. fuliginosus* in captivity and how it compares to other previously studied marsupials. Kirsch and Waller (1979) briefly described some behavior patterns which we expand upon, providing comparative information for future studies. These include aspects on locomotion, posture, feeding "preferences," and manipulation, following the descriptions of Streilein (1982), González and Claramunt (2000), and Martin and Udrizar Sauthier (2011). Due to the paucity of information about this peculiar marsupial, we also describe several traits that could be explored in other marsupials (e.g., agonistic behavior, tail use when climbing, jumping ability, daily activity patterns).

MATERIALS AND METHODS

Seventeen specimens of *C. fuliginosus* were captured at Finca La Martinica (5°4′1″N, 75°22′42″W, Departamento Caldas, Colombia) and kept in plastic terraria of 2 different sizes: 66×40×31 cm and 34×21×12 cm. Information on specimens collected are described in Appendix I. Individuals were maintained for variable periods of time from 1 to 12 consecutive days, and with 2 kinds of substrates: wood-shavings and a mixture of mosses and lichens from their natural habitat. Individuals were initially kept separately and with small cardboard boxes to use for shelter and later placed together in the largest plastic terraria/containers. A maximum of 3 individuals were kept in the same terrarium at any given time, to observe intraspecific interactions. Photoperiod of each terrarium resembled the season's natural conditions (i.e., 13–11 h of day/night, respectively). Temperature in each terrarium tracked the natural environment, which fluctuated between 4°C and 25°C (measurements were taken using an infrared thermometer pointed at the walls and base of the terrarium).

We studied locomotion with the aid of digital cameras, which we used to record animal movements on horizontal substrates and while climbing, following the terminology of Inuzuka (1996). For our observations on locomotion, wooden sticks of different sizes were placed vertically and horizontally, and climbing behavior observed to evaluate the grasping ability of both hands and feet (if any), and to observe if the tail aided grasping or balance (see Martin and Udrizar Sauthier 2011). Evidence of digging behavior was also recorded. Special attention during these activities was focused on the position and action of fore and hind limbs, as well as body posture and tail position.

We analyzed the exploratory behavior of *C. fuliginosus* and compared it with the descriptions in Martin and Udrizar Sauthier (2011) for *Lestodelphys halli* and other didelphids (see also McManus 1970; Streilein 1982; González and Claramunt 2000).

Experimental qualitative observations on feeding preferences were conducted using a variety of live and dead prey items, animal and vegetable matter, fruits, and other available items which included: live and dead rodents (i.e., *Microryzomys* sp., *Thomasomys* sp.; Rodentia, Sigmodontinae), frogs (i.e., *Pristimantis* sp.; Amphibia, Anura, Craugastoridae), moths and butterflies (Insecta, Lepidoptera), stick insects/walking sticks (Insecta, Phasmatoidea), earthworms (Annelida, Oligochaeta), terrestrial planarians/flatworms (Platyhelminthes, Turbellaria), chicken eggs (both raw and boiled), and vegetables. Several items of different origin were made available at any one time, while we observed which the animals chose.

The posture of each individual was documented during feeding and compared with that of other New World marsupial species (e.g., *Lestodelphys halli*, Martin and Udrizar Sauthier 2011; *Monodelphis dimidiata*, González and Claramunt 2000; Streilein 1982; *Marmosa robinsoni*, Boggs 1969) and the information presented by Kirsch and Waller (1979) on other caenolestids. Special attention was focused on the use of forefeet in food manipulation, how the individual's vertebral column was oriented (e.g., vertically or horizontally relative to substrate), and the use of hindfeet during feeding.

We evaluated the occurrence of torpor and/or hibernation through direct observation by reducing the amount of food provided for periods of 2–4 days, while keeping temperature within ambient range ~10°C to ~20°C. Before this, food was provided ad libitum to see if tails incrassated during short periods as has been documented for *L. halli* and other marsupials living in environments with variable food resources (Morton 1980).

All behavior described above plus other aspects that could be of interest in further comparisons (i.e., resting/sleeping posture, grooming) was documented randomly at irregular intervals both by day and night (0900–1100, 1500–1800, 2100–2300, 0030–0200, and occasionally 0400–0600), and with the aid of photographic/video cameras. Comparisons were then made with the information presented by Kirsch and Waller (1979), and that for other New World marsupials species (McManus 1970; Streilein 1982; González and Claramunt 2000; Martin and Udrizar Sauthier 2011; and literature therein).

Results and Discussion

All individuals studied were adults, with fully erupted dentition. The reproductive condition in males varied from active, with a incrassated epididymis and enlarged testicles (8.5 mm length by 5.2 mm width), to inactive, with an inconspicuous epididymis and small testicles (2.2 mm length by 1.6 mm width). For females, none of the studied individuals were lactating, pregnant, or with attached young. Except where noted, we observed no differences in behavior between males and females. Throughout our study, no scent marking or estrous stimulation were observed.

Locomotion

All individuals studied moved throughout the terraria quadrupedally, similar to what Kirsch and Waller (1979) observed. We did not observe instances of ricochetal or saltatorial progression and/or locomotion as suggested Gregory (1922). When moving at normal speeds (i.e., not running) and on even substrates, specimens walked in a primarily diagonal sequence (sensu Inuzuka 1996), in which limbs on each side of the body move forward alternately and not together (Fig. 1). This is in contrast to observations of different didelphid species, especially those with a predominantly terrestrial locomotion (Vieira and Delciellos 2012; and literature cited therein). We did not observe any lateral or sagittal bending of the trunk, in dorsal and lateral views, respectively, as Pridmore (1992) described for *Monodelphis domestica*. The hands and feet of *C. fuliginosus* are used differently during locomotion, forefeet are clearly plantigrade while hindfeet are digitigrade, even when moving on different substrates (e.g., the terrarium floor, different sized sticks, wooden inclines) (Supporting Information S1).

Individuals of *C. fuliginosus* were able to climb well on different sized branches and sticks (Supporting Information S2). Forefeet were used first to grasp, followed by a push of their powerful hindfeet. Despite not having grasping hands or feet, or specialized pads for climbing, individuals were able to move quickly and without losing grip in substrates of different diameter and inclination. We also recorded their ability to make vertical and diagonal jumps using the hind limbs, with a distance jumped of about 20–30 cm, a behavior similar to that described for *L. halli* and *M. dimidiata* (González and Claramunt 2000; Martin and Udrizar Sauthier 2011).

We found that the tail was never used as a grasping aid or balance organ during locomotion, even on narrow branches. The tail remained still on 1 side during climbing and no balancing

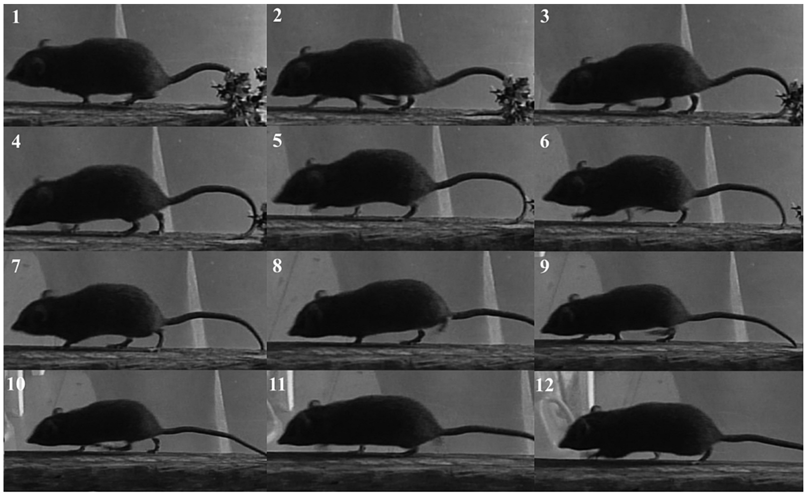

Fig. 1.—Locomotion in *Caenolestes fuliginosus* showing a primarily diagonal walking sequence (sensu Inuzuka 1996) in which limbs on each side of the body move forward alternately and not together.

movements where registered (Supporting Information S2). A similar pattern was observed in *Dromiciops gliroides* during what Pridmore (1994) described as "steady-velocity locomotion along any of the substrata" and is in contrast to observations on most didelphid marsupials (even those with short tails as *L. halli* or *M. dimidiata*), where the tail is used as a 5th member in aid to grasping and/or climbing (González and Claramunt 2000; Martin and Udrizar Sauthier 2011; Vieira and Delciellos 2012). Despite this, the tail was used as a support when individuals intended to climb the terrarium, keeping the full body supported while hands and feet were holding on to the terrarium's walls (Fig. 2A). This behavior was briefly documented by Kirsch and Waller (1979), and we are able to confirm this as part of the common behavior of *C. fuliginosus* based on the observation of several individuals. We did not observe and/or record any digging behavior in any of our captive individuals.

Exploratory behavior

The exploratory behavior of *C. fuliginosus* was similar to that observed in other New World marsupials (e.g., *Didelphis virginiana*, *D. albiventris*, *M. domestica*, *M. dimidiata*, and *L. halli* (McManus 1970; Streilein 1982; González and Claramunt 2000; Martin and Udrizar Sauthier 2011), in which the initial movements were slow, the head was kept erect at the shoulder level and the muzzle higher, "sniffing" the air. Unlike didelphids, during exploration, the tail was kept touching the ground and directed backwards but not erect, ears were erect. If a loud sound was heard, ears quickly start moving in different directions, probably to gain information from where the sound was coming and if it implied a threat.

Feeding preferences and posture

During our observations, *C. fuliginosus* showed a clear preference for items of animal origin, especially live arthropods and annelids. Although offered on several occasions, we did not observe consumption of raw eggs. Also, individuals avidly consumed dead rodents of the genera *Thomasomys* and *Microryzomys* but not live animals, i.e., they did not attack or kill rodents as described by Kirsch and Waller (1979). We did observe, albeit only on 3 occasions, an aggressive behavior when rodents of the genus *Microryzomys* and *Thomasomys* (not of the *aureus* group; sensu Pacheco 2015) got too close and individuals probably felt threatened (compared size of adult *Thomasomys* sp. [$n = 8$], *Microryzomys* sp. [$n = 9$], and *C. fuliginosus* [$n = 16$] are: 115 ± 8.7 mm, 76.7 ± 13.5 mm, and 105.7 ± 13.9 mm of total body length [$\bar{X} \pm SD$]; 31.5 ± 7.1 g, 12.7 ± 3.6 g, and 22.9 ± 8.8 g of body mass [$\bar{X} \pm SD$]). A few cases of cannibalism were observed when congeners died in the terraria, which were consumed in the same manner as with dead rodents (see below).

Individuals fed throughout the day in feeding bouts that lasted for several minutes and were very intense. After feeding, animals relaxed and sometimes fell asleep. Eventually, during intense feeding bouts individuals would stop and apparently sleep for a period between 30 and 120 s, only to resume activities intensely again. We provided 2 main item types that were consumed differently: slowly moving annelids and arthropods (e.g., stick-insects, earthworms, flatworms) and fast moving arthropods and vertebrates (e.g., moths, centipedes, millipedes, frogs). Slow-moving prey was manipulated by the individuals with their forefeet, items were placed on the side of the mouth and chewed with premolars and molars (Figs. 2B–D). We did not observe any involvement by the peculiar integumentary "flap-lips" (i.e., those that lie superficial to the cheek teeth) during mastication or prey manipulation.

The consumption of terrestrial planaria/flatworms was different from other items because individuals scraped the surface with their claws in a very fast action, probably to remove

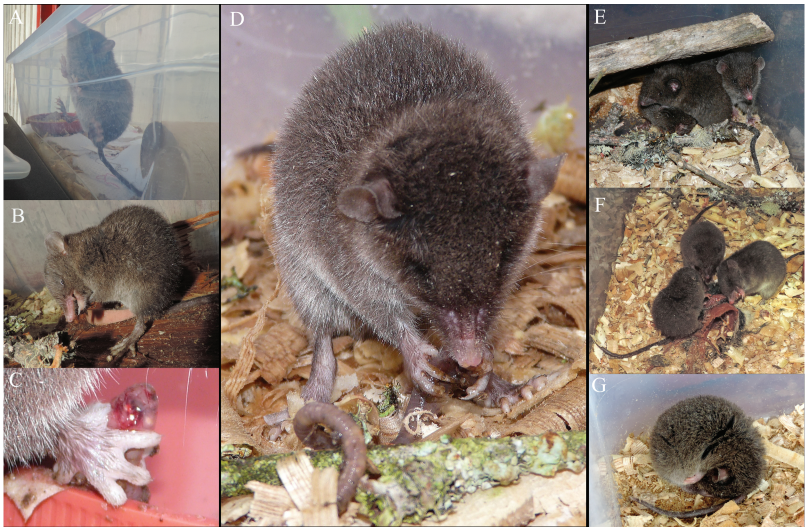

Fig. 2.—The dusky shrew-opossum, *Caenolestes fuliginosus*, in different postures and behavior activities. A) One individual using the tail as support, while the body climbs vertically on a terrarium wall; B) erect posture when feeding individually, showing lateral chewing by molars; C) close-up detail of grasping hand; D) erect posture when feeding individually on insects or similar items, showing a 2-hand grasping behavior; E) group resting, showing individuals on top of each other; F) 3 individuals showing non-aggressive group feeding on a *Thomasomys* carcass; G) most frequent resting position when alone.

as much mucous from their surface as possible, and then proceeded to manipulate and eat them as described above (Supporting Information S3). According to Hyman (1951) and Winsor (1998), the mucous of land flatworms have different functions (e.g., locomotory, prey capture, repugnatorial/predatory deterrence), although little is known about how taxonomically specific these secretions are. We interpret the scraping behavior observed in *C. fuliginosus* as a way of reducing the amount of repugnatorial mucous (toxins?) before ingestion.

Fast moving items were first picked up or pinned-down with the procumbent lower incisors, then immediately held by the forefeet and manipulated to the sides of the mouth for consumption. During feeding, *C. fuliginosus* holds the food items with 1 or both hands (Figs. 2C and 2D) and assumed an erect or semierect posture, standing on its hindfeet while keeping the body above the substrate. In all our observations, the tail remained posteriorly extended and "out of the way," in a tripod stance where the tail provides complementary support to the legs while feeding. This is similar to the feeding posture described for some New World marsupials (e.g., *Marmosa robinsoni*, *Thylamys karimii*, *Thylamys fenestrae*, with the exception of *L. halli*), in which individuals adopt a semierect posture and use the forepaws to manipulate and carry food to their mouths (Bruch 1917; Streilein 1982; Martin and Udrizar Sauthier 2011).

When dead rodents were provided (or congeners died), individuals ate the abdominal skin and worked their way into the abdominal cavity consuming the stomach, intestines, heart, lungs, and other organs. After this, individuals consumed muscles from legs and thighs, leaving the head and tail almost untouched. Feeding on carcasses took from 1 to more than 5 h. When feeding on dead carcasses, animals would stand on their hindfeet, hold the dead rodents with their forefeet and proceed to use their procumbent incisors to "dig" into the carcasses, and slice pieces of flesh while moving their heads for better leverage (Supporting Information S4); pieces of flesh were chewed with the molars. Much has been speculated on the use of the procumbent incisors in caenolestid marsupials (e.g., Osgood 1921; and literature cited therein), with Kirsch and Waller (1979) describing their use from direct observations. Our observations provide new insights into the use of procumbent incisors as a way to "dig" into dead carcasses and gain access to deeper organs and/or muscles, and slice flesh with their outer edges, a characteristic also found in incisors of *Lestoros inca* (Martin 2013) and *Rhyncholestes raphanurus* (Martin 2007). On occasions, we observed individuals trying to feed on a dead rodent's head, probably trying to gain access to the brain as most other New World marsupials do (see Martin and Udrizar Sauthier 2011, and literature cited therein). In cases of cannibalism, with the exception of palate and mandibles, the head was almost completely eaten. When feeding on carcasses, individuals aggregated without aggressive behavior towards their congeners, sometimes even standing on top of one another (Fig. 2F; Supporting Information S4), a feeding behavior that was not observed when animals consumed smaller items.

To our knowledge, group feeding has never been documented in New World marsupials and is not a common marsupial behavior. Most New World marsupials are solitary and/or aggressive towards congeners, especially when feeding. Australian carnivorous marsupials are also solitary, but Tasmanian devils (*Sarcophilus harrisii*) aggregate to feed from carcasses of large prey, as documented by Jones (1988). Unlike Devils, which tend to feed at opposite ends of carcasses or space themselves around the carcass at whisker-touching distance (Jones 1988), *C. fuliginosus* was tolerant of congeners, even though constantly jostling and shoving each other sideways (Supporting Information S4).

Contrary to the behavior described for other New World marsupials (González and Claramunt 2000; Martin and Udrizar Sauthier 2011), no cleaning/washing was observed before or after feeding, except when the snout/muzzle had abundant blood and individuals proceeded to clean it in the way described by Kirsch and Waller (1979). Grooming/cleaning of the snout was also observed when individuals woke up and were not necessarily related to feeding.

The tails of captive animals that were fed daily did not increase in thickness (i.e., incrassate). Caudal fat storage is an adaptation present in some small mammals that live in seasonal environments, or those which live in places where food availability fluctuates drastically (Morton 1980; Tyndale-Biscoe 2005). This adaptation is present in some New World marsupials like *D. gliroides* and the caenolestid *R. raphanurus*, endemic to the temperate rainforests of southern Argentina and Chile, in *L. halli* and in species of the genus *Thylamys*, which live in dry, cold, and temperate environments of South America (Morton 1980; Tyndale-Biscoe 2005; Martin 2008; Martin and Udrizar Sauthier 2011; Geiser and Martin 2013). It is also common in many small dasyurid marsupials that inhabit desert environments in central Australia and is present in some rodents, insectivores, and lemurs (Morton 1980; Tyndale-Biscoe 2005; McAllan et al. 2012). Based on the data available for other New World marsupial species (e.g., *L. halli*, *Thylamys* spp.—Martin and Udrizar Sauthier 2011), we interpret this lack of tail incrassation (an adaptation to store energy in the form of fat), as an indication that feeding resources for *C. fuliginosus* are available throughout the year or fluctuate within narrower limits, but not to the extremes encountered by other species.

Small vertebrates tend to lose heat faster than larger ones due to their surface to volume ratio, especially in cold or temperate-cold environments (McNab 1978, 1983). To cope with heat loss or fluctuating food resources, torpor and/or hibernation are sometimes coupled with tail incrassation as energy saving mechanisms (Lee and Cockburn 1985; Geiser 2003). All individuals we observed remained active during several hours throughout the day, not showing the typical nocturnal or crepuscular peak in their behavior, which could be associated with daily torpor. Despite the fact that we did not have the appropriate equipment to measure this process precisely, when deprived of food, our captive specimens did not enter torpor.

Other observations

Resting/sleeping postures.—In what is considered the "typical" resting behavior documented for most New World marsupials (e.g., *Caluromys derbianus*, *Didelphis* spp. *M. domestica, Thylamys fenestrae*), individuals lie on their sides with their fore and hind limbs extended more or less from the body depending on environmental conditions (i.e., closer to the body when it is colder; extended when it is warmer) (Bruch 1917; Hall and Dalquest 1963; Streilein 1982). Only when thermal conditions become adverse (e.g., low temperatures, rain), they adopt a curled position in which the head was placed between the forelimbs and close to the body. In contrast, *C. fuliginosus* rested in a curled anterovertical posture with its head close to the venter, and its tail surrounding the body on either side or posteriorly extended (Fig. 2G). This posture was also observed in resting individuals of *D. gliroides* (Martin 2008) and *L. halli* (Martin and Udrizar Sauthier 2011), even when thermal conditions were not adverse or extreme (temperatures remained about 20°C), and was described for a single individual of *Caenolestes* by Kirsch and Waller (1979). Our observations show this is the typical resting position for solitary *C. fuliginosus*. When placed with other congeners in the same terrarium, individuals aggregated and slept on top of one another (Fig. 2E), probably as a means to conserve body heat. This behavior was observed between males and females of different size, with no dominance of one over another. Although this behavior has been documented for *D. gliroides* (Franco et al. 2012), and very recently for several didelphids by Astúa et al. (2015), we cannot assume this is a common strategy of *C. fuliginosus* in the wild. Further research using artificial nests could add information on this behavior, which might turn out to be more common in New World marsupials.

Hunsaker and Shupe (1977), Fadem et al. (1986), Croft (2003), Tyndale-Biscoe (2005), and Martin and Udrizar Sauthier (2011) describe how nest-building behavior in marsupials can serve different purposes, apart from those associated with reproduction. Thus, nests might be important as a means to preserve body heat during cold nights, helping individuals to thermoregulate, provide shelter from predators, and isolate individuals from fluctuating weather conditions. We found no evidence of nest-building behavior in *C. fuliginosus*, even though we provided different types of materials that could be used for this purpose (e.g., wood scrapings, moss, paper towels).

Grooming.—Although previous studies have described more or less constant grooming in various species of New World marsupials (Bruch 1917; Streilein 1982; González and Claramunt 2000), we found little evidence of constant grooming activities in *C. fuliginosus*. When observed, grooming follows the patterns described by González and Claramunt (2000) for *M. dimidiata* and *L. halli* by Martin and Udrizar Sauthier (2011). On occasions, *C. fuliginosus* was observed licking the dorsal and ventral surfaces of the hand, sticking its tongue between its fingers, before "combing" its mystacial and superciliary or supraorbital vibrissae (sensu Brown 1971), and using its hindlimbs for scratching instead of washing. Similar patterns were also observed in other marsupials and can be considered typical for small mammals (Eisenberg 1981; Baker 2015).

Intraspecific agonistic behavior.—When different individuals (i.e., males–males, males–females) were placed in the same terrarium, no hostile/agonistic behavior was observed. As described above, animals slept and fed together without any aggressive behavior observed. Different levels of intrasexual hostility/aggression have been described for some small opossums, such as *M. robinsoni* (Boggs 1969), *Monodelphis dimidiata* (González and Claramunt 2000), and *Thylamys pallidior* (D. Udrizar Sauthier, pers. obs.), which are apparently not common in *C. fuliginosus*. Also, Boggs (1969, *fide* Hunsaker and Shupe, 1977) found that *M. robinsoni* formed social hierarchies in captivity, a behavior we did not observe in *C. fuliginosus*. Holmes (1991) recorded spontaneous social interactions between group-housed individuals of *Didelphis virginiana*, while Guillemin et al. (2000) recorded different levels of dominance-submissive relationships in *Caluromys philander*, based on age and body mass. Croft (2003) described the agonistic relationships between most dasyurid species as "socially intolerant." In our experiments, males and females of different weights were placed together but we recorded no aggressive or avoidance behavior (body weight ranged from 20 to 45 g in males and 15 to 21 g in females).

When specimens felt threatened, a characteristic and very high pitched sound was made (similar to a "cric...cric...cric"), which is often accompanied by the opening of the mouth, a bipedal posture and with up-to-down movements of the hands. Apart from this, it was frequent to hear a snap which is done with its teeth (mainly molars) in diverse situations of threat, consistent with what has been described for dasyurids (e.g., *S. harrisii*—Eisenberg et al. 1975), and some didelphids (e.g., *L. halli*, *Metachirus nudicaudatus*, *M. dimidiata*—González and Claramunt 2000; Rossi et al. 2006; Martin and Udrizar Sauthier 2011). From an alert or defensive position, specimens adopted an aggressive behavior only when contact with a different subject is imminent, which elicits a bite as described for *T. fenestrae*, *M. dimidiata*, and *L. halli* (Bruch 1917; González and Claramunt 2000; Martin and Udrizar Sauthier 2011).

This work represents the 1st continuous observations on the captive behavior of various species of *C. fuliginosus*, information that should stimulate further studies. Our observations expand on the reports by Kirsch and Waller (1979) and Barkley and Whitaker (1984), adding new data on a poorly known species of New World marsupial. Future work should concentrate on expanding our knowledge on the behavior of this and other caenolestids, a group of intriguing South American marsupials.

ACKNOWLEDGMENTS

The authors wish to express their gratitude to E. Watkins and V. Rojas-Diaz for the economic support, C. Brand and D. Arenas who assisted us during field work in Colombia, engineer J. Uribe for allowing us into Finca La Martinica, and F. Montoya and family for their hospitality. We also wish to thank H. Tyndale-Biscoe, reviewers D. Astúa, B. Patterson, and an anonymous reviewer for their suggestions to improve the original manuscript.

Supporting Information

The Supporting Information documents are linked to this manuscript and are available at Journal of Mammalogy online (jmammal.oxfordjournals.org). The materials consist of data provided by the author that are published to benefit the reader. The posted materials are not copyedited. The contents of all supporting data are the sole responsibility of the authors. Questions or messages regarding errors should be addressed to the author.

Supporting Information S1.—Locomotion of *Caenolestes fuliginosus* on an even substrate, showing the diagonal sequence, the plantigrade and digitigrade use of its fore and hindfeet, respectively, and the position of the tail.

Supporting Information S2.—Locomotion of *Caenolestes fuliginosus* on narrow branches, showing its ability to move, and the non-use of the tail as a 5th member or grasping aid.

Supporting Information S3.—Behavior of *Caenolestes fuliginosus* scraping the surface of a flatworm to remove mucous from its surface before consumption.

Supporting Information S4.—Group feeding in *Caenolestes fuliginosus* showing non-aggressive behavior towards congeners. Also, the use of incisors for digging and slicing is shown, albeit briefly.

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Submitted 8 June 2015. Accepted 24 November 2015.

Associate Editor was Marcus V. Viera

Appendix I

Specimens of *Caenolestes fuliginosus* (Tomes) collected during this study, including their sex and reproductive stage.—All specimens are housed at the Mammal Collection of Universidad del Valle, Cali, Colombia. Field Collector numbers are from BG-C.

Colombia: Departamento Caldas, Forest Preserve La Martinica, basin of Río Blanco river, 3,450–3,780 m, 5°4′1″N 75° 22′42″W. Reproductive males: BG-C 074, BG-C 075, BG-C 080, BG-C 082, BG-C 096, BG-C 097, BG-C 103; Nonreproductive males: BG-C 072, BG-C 076, BG-C 081, BG-C 093, BG-C 094, BG-C 098, BG-C 099; Nonreproductive females: BG-C 087, BG-C 091, BG-C 125.