REARING CYCLE AND OTHER REPRODUCTIVE PARAMETERS
OF THE XEROPHITIC MOUSE OPOSSUM Marmosa xerophila
(Didelphimorphia: Didelphidae) IN THE PENINSULA OF PARAGUANA,
VENEZUELA

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SUMMARY

Some reproductive parameters were measured in 60 adult females of Marmosa xerophila to infer the significance of some adaptations to a semi-arid ecosystem when compared to M. robinsoni, a filogenetically closely related species inhabiting more humid environments. The study was carried out in a tropical thorny woodland in the Peninsula of Paraguaná, Falcon State, Venezuela. Field data were collected by two methods: capture-mark-recapture and radioactive tagging. A reproductive peak occurred in June and July, during the dry season. Post-lactating females were detected from July to February. There was no reproductive activity from March to May. The rearing cycle lasted 60 days and the mean litter size was 7.9 young. The reproductive strategy of M. xerophila is similar to the rainforest species M. robinsoni, reflecting a great plasticity that allows Marmosa species to adapt successfully to different Neotropical ecosystems.

KEYWORDS / Didelphidae / Marmosa xerophila / Reproduction / Semiarid Zones / Venezuela /

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CICLO DE CRIA Y OTROS PARÁMETROS REPRODUCTIVOS DE LA COMADREJITA XERÓFITA Marmosa xerophila (Didelphimorphia: Didelphidae) EN LA PENÍNSULA DE PARAGUANÁ, VENEZUELA
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RESUMEN

Algunos de los parámetros reproductivos fueron medidos en 60 hembras adultas de Marmosa xerophila para inferir el significado de algunas de sus adaptaciones a ecosistemas semiáridos cuando se comparan con aquéllas de M. robinsoni, una especie presente en sistemas más húmedos y a la que está estrechamente relacionada filogenéticamente. El estudio se llevó a cabo en un arbustal seco espinoso en la Península de Paraguaná, Estado Falcón, Venezuela. Los datos de campo se colectaron usando dos métodos: captura-marcado-recaptura y uso de etiquetas radioactivas. Un pico reproductivo se presentó en la estación seca, entre junio y julio. Las hembras con señales de haber destetado sus crías eran más evidentes entre julio y febrero. No se observó actividad reproductiva en las hembras entre marzo y mayo. El ciclo reproductivo duró 60 días y el tamaño promedio de la camada fue 7,9 crías. La estrategia reproductiva de M. xerophila es similar a la de M. robinsoni que habita selvas tropicales, lo que refleja una gran plasticidad que permite a estas especies adaptarse exitosamente a diferentes ecosistemas Neotropicales.

CICLO DE CRIAÇAO E OUTROS PARÂMETROS REPRODUCTIVOS DA CÚICA XERÓFILA Marmosa xerophila (Didelphimorphia: Didelphidae) NA PENÍNSULA DE PARAGUANÁ, VENEZUELA
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RESUMO

Foram medidos alguns parâmetros reprodutivos de 60 fêmeas adultas de M. xerophila para inferir sobre o quão significativas são algumas adaptações ao ecossistema semi-árido comparando-os com M. robinsoni. O estudo foi realizado em um bosque espinhoso tropical na Península de Paraguaná, Estado Falcon, Venezuela. Os dados de campo foram coletados usando dois métodos: captura-marcação-recaptura e uso de etiquetas radioativas. Um pico de reprodução ocorreu em junho e julho, durante a estação seca. Fêmeas pós-lactantes foram detectadas de julho a fevereiro. Não houve atividades reprodutivas de março a maio. O ciclo de criação dura 60 dias e o tamanho médio da ninhada foi de 7,9 jovens. A estratégia reprodutiva de M. xerophila é similar a de M. robinsoni de floresta tropical, refletindo uma grande plasticidade que permite às espécies do gênero se adaptarem com êxito em diferentes ecossistemas Neotropicais.
weaning, shorter dispersal time and smaller birth body size than *M. robinsoni*. On the other hand, *M. xerophila* had a longer teat-attachment phase, dorsal pigmentation and dorsal fur were completed later and nest phase started at an older age. Finally, litter size in *M. xerophila* was similar to that registered in *M. robinsoni* inhabiting forested habitats, but lower than that from *M. robinsoni* from the Venezuelan Llanos.

**Discussion**

There is limited information available for many species of mouse opossums (Hayssen *et al.*, 1993), for the genus *Marmosa*, and therefore little is known on the reproductive patterns of such species. Walker (1975) suggested that several mouse opossum species breed from one to three times per year in cool habitats and throughout the year in areas with tropical climate. Indeed, available data show great variation among species, with *M. canescens* reproducing all over the year (Ceballos and Miranda, 1986; Ceballos, 1990) and other species showing marked seasonality in reproduction, most of them having their reproductive activity correlated to precipitation (O’Connell, 1979; Fleck and Harder, 1995; Martins *et al.*, 2006). On the other hand, some other species as *Marmosops incanus* (Lorini *et al.*, 1994) and *Thylamys elegans* (Mann, 1978) breed in the driest season of the year.

*M. xerophila* and *M. robinsoni* show a seasonal reproductive biology. In both species, reproduction starts at the end of the dry and beginning of the wet seasons (Enders, 1966; Fleming, 1973; August, 1984; O’Connell, 1989). Although beginning of rainfall could trigger reproduction, Fleming (1973, 1975) reported that synchronization of reproduction depends on more complex factors, such as a strong selective pressure for the young to wean when there is greater food availability and adults being energetically more active; that is, adults being more capable to allocate more energy for those events related to reproduction (Gittleman and Thompson, 1988). In this sense, in the area of the present study, Thielen *et al.* (1997b) reported a peak of ripe fruits and invertebrates corresponding with the breeding season and weaning of young, respectively.

In marsupials, litter size is inversely correlated and duration of maternal care is directly correlated to body mass, especially for small didelphids, in which larger litter size seems to be more important than shortened age at weaning or earlier maturation (Thompson, 1987). The present data diverges from this tendency, as litter size and body size of *M. xerophila* were smaller than *M. robinsoni* from the Venezuelan Llanos (O’Connell, 1983; López-Fuster *et al.*, 2000), and young *M. xerophila* developed slower than *M. robinsoni* (Eisenberg and Maliniak, 1967; Collins, 1973; O’Connell, 1979; Eisenberg, 1983). However, dispersal was reached faster than in *M. robinsoni* and in a gradual manner, probably when young follow their mother to foraging excursions and accidentally or intentionally, walk away.

Fleming (1973, 1975) and O’Connell (1989) found that *M. robinsoni* produced up to two litters in the same year, but tendency is to have only one. Mean litter size was 10 young (6-13, n=7) in the rainforest (Fleming, 1973), and 14 young (13-15, n=13) in the Venezuelan Llanos (O’Connell, 1979, 1989), so annual productivity for these two ecosystems is 10.0 and 19.6 young, respectively. This difference is in concert with the López-Fuster *et al.* (2000) report that individuals of *M. robinsoni* coming from secondary growth habitats, such as the Venezuelan Llanos, are bigger and heavier than those found in primary forests, owing to the higher Llanos annual productivity. *M. xerophila* from the present study area and *M. robinsoni* from the rainforest showed comparable values of productivity per female, and data of both species could have been influenced by the low productivity registered in these habitats.

Spencer and Steinhoff (1968) and O’Connell (1979, 1989) reported a selective pressure on didelphids in highly variable habitats where the tendency is to produce few big litters during the most favorable season. Thielen (1996), Thielen *et al.*
(1997a), Hunsaker (1977) and O’Connell (1979, 1989) considered this factor as an adaptive mechanism to compensate for the short reproductive life of females and high mortality of young in these areas.

Thielen (1996) and Thielen et al. (1997a) reported females of M. xerophila becoming sexually mature at nine months old and surviving for a short time after a year of age. O’Connell (1989), in the Venezuelan Llanos, found that females of M. robinsoni became sexually mature as young as six months of age; however, Hunsaker (1977) and Godfrey (1975) suggested a minimal period of 8–9 months to reach sexual maturity. O’Connell’s findings could be due to a long wet season favorable influence. Fitch and Sandidge (1953) interpreted Delphinus virginianus semelparity by saying that either females are preyed upon after first breeding or they remain too exhausted to breed for a second time. Climate and diet could be important factors affecting multiparity (Hunsaker, 1977).

The adaptive strategy of these closely related species of Marmosa is similar, reflecting a plasticity that helps the species overcome the differences that characterize each ecosystem. Further studies would be necessary to confirm that this plasticity makes the genus Marmosa not only the most diverse of the Didelphidae family, but also a mammal group distributed successfully in the different Neotropical ecosystems.

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