ISSN 1517-6770

Short Comunication

Accidental captures of small mammals in insects trap: suggestions to avoid these incidents and use of trap and bait to capture small mammals

Fábio André Facco Jacomassa[1]* & Mateus Aparecido Clemente[1]

*[1]Departamento de Zoologia, Instituto de Biociências, Universidade Estadual Paulista, Rio Claro, São Paulo, Brazil. E-mails: * fabioafj@gmail.com; mateus1981@gmail.com.*

Abstract. We present here accidental captures of small mammals in insects traps made of PET bottles using passion fruit juice as bait. Between October 2011 and July 2013, with an effort of 300 PET bottles twenty-six of them captured small mammals but only six of them could be identified. These animals may have been attracted by the strong odor passion fruit, the fermenting juice with insect carcasses, or live baits, or perhaps may have attempted to use the PET bottle as a refuge. Even that these records were fortuitous we suggest as avoid these incidents and the use of passion fruit as bait in PET bottles as an inexpensive trap for research with small mammals.

Keywords: Marsupials, Passion Fruit, Low Cost, PET Bottles, Rodents.

Resumo. Capturas acidentais de pequenos mamíferos em armadilhas para insetos: sugestões para evitar esses incidentes, e de uso de armadilha e isca para captura de pequenos mamíferos. Apresentamos capturas acidentais de pequenos mamíferos em armadilhas para insetos feitas de garrafas PET usando suco de maracujá como isca. Entre outubro de 2011 e julho de 2013, com esforço de 300 garrafas PET, 26 delas capturaram pequenos mamíferos, mas apenas seis deles puderam ser identificados. Esses animais podem ter sido atraídos pelo forte odor de maracujá, pela fermentação do suco com as carcaças de insetos, ou iscas vivas, ou talvez possam ter tentado usar a garrafa PET como refúgio. Mesmo que esses registros tenham sido fortuitos, sugerimos como evitar esses incidentes, o uso de maracujá como isca e garrafas PET como uma armadilha de baixo custo em pesquisas com pequenos mamíferos.

Palavras-chave: Baixo custo, Garrafas PET, Maracujá, Marsupiais, Roedores.

'Small mammal' is the general term used for any non-volant mammal with small size and mass (in many cases weighing less than 1 kg as adults, Chiarello, 2000). This group includes rodents, marsupials, eulipotyphlans, and elephant shrews (Barnett & Dutton, 1995; Pearch, 2011). There are 286 small mammal species in Brazil (55 marsupials and 231 rodents), representing about 40.7% of all mammal species in the country (Paglia *et al.,* 2012). The number

of mammal species is likely underestimated for several reasons. First, capture can be difficult despite the use of various capture methods and attractive bait types. Second, mammal studies often use trap types that can be selective. Finally, there is a paucity of cytogenetic and molecular studies of Brazilian mammal fauna, and large swaths of the vast Brazilian territory have yet to be sampled or studied (Paglia *et al.,* 2012).

The most common capture methods include pitfall, Young, Sherman and Tomahawk traps, but other trap types are sometimes used like snap traps, funnel traps, and bottle traps (Barnett & Dutton, 1995; Santos-Filho *et al.*, 2006). The bait types used are as variable as the traps, and include porridge oats, peanut butter, oils mixed with flours, fresh fruits, fruit juices, fresh and canned meats and fishes, bacon, essential oils, fermented mixes and cereal seeds, or a combination of two or more of these items (Barnett & Dutton, 1995; Astúa *et al*,. 2006).

Despite the numerous currently employed methods, the possibility of undersampling suggests that new suggestions should be welcome. We present here accidental and fortuitous captures of small mammals that fell in insects traps (two-liter PET - bottles made of polyethylene terephthalate) using passion fruit juice as bait.

The traps were constructed of empty two-liter PET bottles with four circular lateral openings measuring 3 cm in diameter (about 7 cm from the base) (Figure 1), which was baited with ~200 ml of attractive solution. This solution was made with two kilos of fresh passion fruit (*Passiflora edulis* Sims: Passifloraceae) plus one kilo of refined sugar diluted in five liters of water. Five traps were installed at a height of approximately 1.5 m tied to a tree, and five traps were installed at a height of approximately 5-9 m suspended by a cord passing through a branch of a tree (Figure 1). Traps were installed every two months in five areas (Atlantic semideciduous forest in Rio Claro municipality - 22°21'32" S, 47°28'41" W; Cerrado in Ipeúna municipality - 22°24'42" S, 47°45'53" W; riparian forest in Itirapina 22°22'46" S, 47°46'56" W; regenerating Cerrado São Paulo

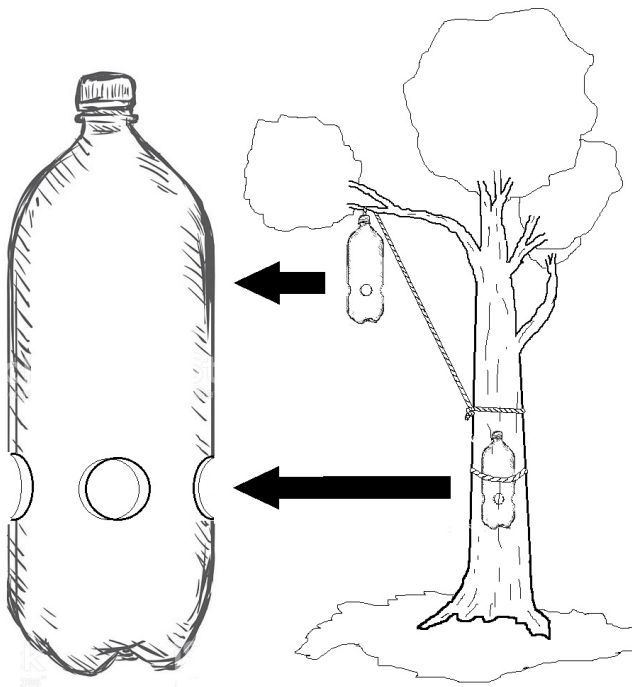

Figure 1. Traps of empty two-liter PET bottles with four circular lateral openings measuring 3 cm in diameter (about 7 cm from the base) installed at a height of approximately 1.5 m tied to a tree, and installed at a height of approximately 5-9 m suspended by a cord passing through a branch of a tree.

State University *campus* in Rio Claro municipality 22°23'47" S, 47°32'40" W; restored area in Iracemápolis municipality - 22°34'09" S, 47°30'19" W) of São Paulo state, southeastern Brazil. The samples were collected one week later to avoid deterioration of the captured insects.

Fieldwork was done between October 2011 and July 2013, and included a total of sixty samples (per area) totaling an effort of 300 PET bottles. During this period twenty-six (8,6%) of them captured small mammals. Only six small mammals (one per sample, 2% of total samples) across four areas that were identifiable. All specimens found dead were probably due to drowning. Other small mammals were also captured in 20 other samples (6,6% of total), but unfortunately their skulls, jaws and other structures were in an advanced state of decomposition at the time of collection and were thus unable to be identified and quantified; these were not recorded. The identified small mammals were as follows:

Gracilinanus microtarsus (Wagner, 1842) (Marsupialia: Didelphidae: Didelphinae). An adult male dead was found on August 16, 2012, in a trap at a height of 1.5 m in a cerrado area in Ipeúna municipality. It was deposited in Zoology Museum of Escola Superior de Agricultura Luiz de Queiroz at the University of São Paulo in Piracicaba, SP, Brazil - ESALQ/USP-234. An adult female was found on February 26, 2013, in a trap at a height of 1.5 m in a restored area (restoration ecology program) in Iracemápolis municipality. The Brazilian Gracile Opossum was alive (it likely had recently fallen into the trap) and was freed. An adult male dead was found on March 21, 2013, in a trap at a height of 1.5 m in a atlantic rainforest remnant in Rio Claro municipality. It was deposited in ESALQ/USP-237. *G. microtarsus* is solitary, nocturnal marsupial and inhabits Atlantic rainforests and semideciduous forests interspersed in the highly seasonal Cerrado in southeastern and southern Brazil (Cherem *et al*., 2004; Martins *et al*., 2006; Gardner, 2007). This species is insectivorous-omnivorous and regarded as arboreal, frequently found in traps placed in forest canopy, and sometimes foraging on the ground (Vieira & Monteiro-Filho, 2003; Paglia *et al*., 2012).

Calomys tener (Winge, 1887) (Rodentia: Cricetidae: Sigmodontinae). An adult male dead was found on November 16, 2012, in a suspended trap at a height of 6 m in a regenerating cerrado field on the São Paulo State University *campus* in Rio Claro municipality. It was deposited in ESALQ/USP-235. The Delicate Laucha is a terrestrial rodent classified as frugivorous-granivorous (Vieira & Baumgarten, 1995; Paglia *et al*., 2012), and occurs mainly in open vegetative formations in the Cerrado and secondary vegetation of both Amazon and Atlantic forest adjacent to the Cerrado, and occurs in central and eastern Brazil, eastern Paraguay, northern Argentina (Misiones), and southeastern Bolivia (Patton *et al*., 2015).

Micoureus paraguayanus (Tate, 1931) (Marsupialia: Didelphidae: Didelphinae). An adult female dead was found on January 18, 2013, in a trap at a height of 1.5 m in a remnant of Atlan-

tic semideciduous forest in Rio Claro municipality. It was deposited in ESALQ/USP-236. The Tate's Woolly Mouse Opossum is nocturnal and inhabits Atlantic rainforests, gallery forests, and Cerrado in southeastern and southern Brazil, eastern Paraguay, and northern Argentina (Misiones) (Talamoni & Dias, 1999; Gardner, 2007). This species is insectivorous-omnivorous frequently caught in traps in forest canopy, and sometimes foraging on the ground (Vieira & Monteiro-Filho, 2003; Paglia *et al*., 2012).

Juliomys pictipes (Osgood, 1933) (Rodentia: Cricetidae: Sigmodontinae). An adult male dead was found on March 23, 2013, in a trap at a height of 1.5 m in a wetland on the São Paulo State University *campus* in Rio Claro municipality. It was deposited in ESALQ/USP-238. The Contrera's Juliomys is a rodent frugivore-seed predator that is primarily arboreal and typically inhabits the low (i.e., ground, Pardinãs *et al*., 2008) to middle 5-8 m strata in mature and secondary Atlantic rainforest and gallery forest. This species is endemic to the Atlantic rainforest of southeastern Brazil, eastern Paraguay, and northeastern Argentina forests (Vieira & Monteiro-Filho, 2003; Pardini & Umetsu, 2006; Patton *et al*., 2015).

Mammals are recognized to have well-developed olfactory apparati. They rely on sense of smell for foraging, territory marking, and reproduction (Doty, 1986; Igbokwe, 2009). These animals may have been attracted by the strong odor of passion fruit or by the live baits such as arthropods, which exude attractive scents and sometimes emit sounds, or by fermenting juice mixed with dead insects (González, 1997; Ghizoni-Jr & Graipel 2005).

In our review about bait use in research with small mammals, we could not find any studies using passion fruit bait. Based on the observations reported here, we suggest the use of passion fruit alone or mixed with other items (e.g., Freitas *et al*., 2013, mixed items of animal and plant origin to produce strong odor and high capture rate) as bait for small mammals.

The capture of *C. tener* in a trap at a height of 6 m emphasizes the attraction of passion fruit bait. This species is considered terrestrial (Vieira & Baumgarten, 1995; Paglia *et al*., 2012), and this is the first record (in literature) of a capture in the canopy. This demonstrates the possibility that species numbers are underestimated by common trapping methods, and that sampling in different strata may increase capture rates. There are generally fewer small mammal captures in the canopy (Vieira & Monteiro-Filho, 2003; Hannibal & Cáceres, 2010), however this strata can house a large number of animals, as noted by Vieira & Monteiro-Filho (2003) in a study wherein 25% of the total species were captured exclusively in the canopy.

Canopy studies with small mammals are typically limited by the inherent difficulty of access (Taylor & Lowman, 1996; Vieira, 1998; Graipel *et al*., 2003). Traps are fixed upon trunks or branches and the researchers must either climb to service the traps, or use a pulley system

that allows raising and lowering of traps (Loeb *et al*., 1999; Graipel *et al*., 2003). Pitfall, Young, Sherman, Tomahawk, Snap, and funnel traps are more expensive that PET bottles (reused after drinking the contents), and more difficult to install in the canopy. To install the PET bottle trap we need the bottle PET, cord, and brass nuts. The cord is tossed (or placed using a telescopic stick) with nuts tied at the tip through a tree branch or fork, and the PET bottle is hoisted to the top. The researcher can use a base outside of the PET bottles to facilitate small mammal entry.

Passion fruit juice can drown and kill small mammals (may also make it difficult to identify by decomposition), but the addition of corn flour can be used to make the bait solid. Barnett & Dutton (1995) comment that the trap serves as a refuge in its entirety, and thus deaths cannot be avoided when the method is used by insect researchers. We suggest that insect researchers place a perch of some type into the PET bottle on the juice blade, even if the perch can also be used by insects. This perch could save the lives of small mammals attracted to the bait as these accidental catches are relatively common.

Even though this method will can select some small mammals (openings with 3 cm in diameter), it can would used. The circular lateral openings may be about 20 cm from the base instead 7 cm to avoid escape of the small mammals. This method can be used alone or in conjunction with other traps to increase the number of catches.

Although the number of accidental catches compared to sample effort (300 PET bottles) was low (8,6%), remembering that the goal was to catch insects, additional studies are needed to test efficacy, passion fruit juice mixed with other items in PET bottles may serve as an inexpensive and effective alternative to other trap types. The researchers can also use of passion fruit in others traps, use PET bottles with varying sizes and dark colours since some species can use the bottles as a refuge.

Acknowledgements

Our thanks to Ricardo Bovendorp for assisting with species identifications, the Laboratory of Mammals of Escola Superior de Agricultura Luiz de Queiroz at the University of São Paulo in Piracicaba, SP, Brazil for receiving the small mammals, Diego Astúa and Enrique González for help us with bibliography, Jennifer Breaux, Paulo Sarti and João Miranda for their valuable comments and suggestions to improve the manuscript. Finally, we acknowledge the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, IBAMA for providing licenses number 29913 and 36688.

References

Astúa, D.; Moura, R.T.; Grelle, C.E.V. & Fonseca, M.T. 2006. Influence of baits, trap type and position for small mammal capture in a Brazilian lowland Atlantic Forest. **Boletim do Museu de Biologia Mello Leitão 19**: 31-44.

Barnett, A. & Dutton, J. 1995. **Small Mammals (excluding bats).** Expedition field techniques, 2nd ed. London, Expedition Advisory Centre, Royal Geographical Society, IX + 131p.

Cherem, J.J.; Simões-Lopes, P.C.; Althoff, S. & Graipel, M.E. 2004. Lista dos mamíferos do estado de Santa Catarina, sul do Brasil. **Mastozoologia Neotropical 11**(2): 151-184.

Chiarello, A.G. 2000. Density and population size of mammals in remnants of Brazilian Atlantic Forest. **Conservation Biology 14**(6): 1649-1657.

Doty, R.L. 1986. Odor-guided behavior in mammals. **Experientia 42**(3): 257-271.

Freitas, M.A.; Miranda, T.F.; França, D.P.F.; Abraão, J.; Oliveira, L.; Silva, D.C.; Araujo, D.; Estavinho, C.; Alves, R.; Hamdan, B.; Nunes, O.C.; Carvalho, M.; Coelho, D.P.; Abreu, R.O. & Silva, T.F.S. 2013. Registros de capturas acidentais de aves e répteis em armadinhas para mamíferos no estado da Bahia, Brasil. **Atualidades Ornitol**ógicas **175**: 41-47.

Gardner, A.L. 2007. **Mammals of South America.** Vol. 1: marsupials, xenarthrans, shrews, and bats. Chicago, Illinois, and London, United Kingdom University of Chicago Press, XVIII + 669p.

Ghizoni-Jr, I.R. & Graipel, M.E. 2005. Capturas acidentais de vertebrados em estudos com pequenos mamíferos no estado de Santa Catarina, sul do Brasil. **Biotemas 18**(1): 163-180.

González, E.M. 1997. Vertebrados (Aves, Reptilia y Amphibia) capturados accidentalmente en trampas para micromamíferos en Uruguay. **Comunicaciones Zoollogicas del Museo de Historia Natural de Montevideo 12**(188): 1-6.

Graipel, M.E.; Cherem, J.J.; Miller, P.R.M. & Glock, L. 2003. Trapping small mammals in the forest undestory: a comparison of three methods. **Mammalia 67**(4): 551-558.

Hannibal, W. & Cáceres, N.C. 2010. Use of vertical space by small mammals in gallery forest and woodland savannah in South-western Brazil. **Mammalia 74**(3): 247-255.

Igbokwe, C.O. 2009. The role of main olfactory and vomeronasal systems in animal behaviour and reproduction. **Animal Reseach International 6**(3): 1093-1101.

Loeb, S.C.; Chapman, G.L. & Ridley, T.R. 1999. Sampling small mammals in southeastern forests: the importance of trapping in trees. **Proceedings of the Southeastern Association of Fish and Wildlife Agencies 53**: 415-424.

Martins, E.G.; Bonato, V.; Da-Silva, C.Q. & Reis S.F. 2006. Seasonality in reproduction, age structure and density of the gracile mouse opossum *Gracilinanus microtarsus* (Marsu-

pialia: Didelphidae) in a Brazilian cerrado. **Journal of Tropical Ecology 22**(4): 461-468.

Paglia, A.P.; Fonseca, G.A.B.; Rylands, A.B.; Herrmann, G.; Aguiar, L.M.S.; Chiarello, A.G.; Leite, Y.L.R.; Costa, L.P.; Siciliano, S.; Kierulf, M.C.M.; Mendes, S.L.; Tavares, V.C.; Mittermeier, R.A. & Patton, J.L. 2012. Lista Anotada dos Mamíferos do Brasil / Annotated Checklist of Brazilian Mammals. 2ª Edição / 2nd Edition. **Occasional Papers in Conservation Biology 6**: 1-76.

Pardiñas, U.F.J.; Teta, P.; D'elía, G. & Galliar, C.A. 2008. Rediscovery of *Juliomys pictipes* (Rodentia: Cricetidae) in Argentina: emended diagnosis, geographic distribution, and insights on genetic structure. **Zootaxa 1758**: 29-44.

Pardini, R. & Umetsu, F. 2006. Pequenos mamíferos não-voadores da Reserva Florestal do Morro Grande: distribuição das espécies e da diversidade em uma área de Mata Atlântica. **Biota Neotropica 6**(2): 1-22.

Patton, J.L.; Pardiñas, U.F.J. & D'elía, G. 2015. **Mammals of South America,** Vol. 2, Rodents. Chicago and London: The University of Chicado Press, XXVI + 1336p.

Pearch, M.J. 2011. A review of the biological diversity and distribution of small mammal taxa in the terrestrial ecoregions and protected areas of Nepal. **Zootaxa 3072**: 1-286

Santos-Filho, M.; Silva, D.J. & Sanaiotti, T.M. 2006. Efficiency of four trap types in sampling small mammals in forest fragments, Mato Grosso, Brazil. **Mastozoologia Neotropical 13**(2): 217-225.

Talamoni, S.A. & Dias, M.M. 1999. Population and community ecology of small mammals in southeastern Brazil. **Mammalia 63** (2): 167-181.

Taylor, P.H. & Lowman, M.D. 1996. Vertical stratification of the small mammal community in a northern hardwood forest. **Selbyana 17**: 15-21.

Vieira, E.M. 1998. A technique for trapping small mammals in the forest canopy. **Mammalia 62**(2): 306-310.

Vieira, E.M. & Baumgarten, L.C. 1995. Daily activity patterns of small mammals in a cerrado area from central Brazil. **Journal of Tropical Ecology 11**(2):255-262.

Vieira, E.M. & Monteiro-Filho, E.L.A. 2003. Vertical stratification of small mammals in the Atlantic rain forest of south-eastern Brazil. **Journal of Tropical Ecology 19**(5):501-507.

Recebido: 17/05/2017
Revisado: 30/05/2017
Aceito: 02/07/2017