

Nests of the Brazilian squirrel *Sciurus ingrami* Thomas (Rodentia, Sciuridae)

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ABSTRACT. Descriptions of *Sciurus ingrami* Thomas, 1901 nests are not available in the literature. In this study, a survey was made of the distribution of *S. ingrami* nests in a woodlot located near to the headquarters of the Serra do Caraça Reserve, in state of Minas Gerais, where there is a high concentration of *Syagrus romanzoffiana* (Chamisso) Glassman palm tree, among other exotic tree species. The nest-building behaviour and the nest characteristics, such as height from the ground, total circumference, diameter of the entrance, and the position of the nest in the tree – in the crown, along the trunk or in a side branch, were described.

KEY WORDS. Food supply, *Syagrus romanzoffiana*, Serra do Espinhaço.

RESUMO. Ninhos do esquilo brasileiro *Sciurus ingrami* Thomas (Rodentia, Sciuridae). Não existe na literatura a descrição de ninhos de *Sciurus ingrami* Thomas, 1901. Neste estudo, foi examinada a distribuição espacial de ninhos desta espécie, localizados em área de vegetação de crescimento secundário, próxima a área construída da Reserva Particular do Patrimônio Natural Serra do Caraça, Minas Gerais, onde há grande concentração da palmeira *Syagrus romanzoffiana* (Chamisso) Glassman, entre outras espécies exóticas de árvores. O comportamento de construção e as características dos ninhos, tais como, altura em relação ao solo, circunferência total, diâmetro da entrada e a posição dos ninhos na árvore foram descritos.

PALAVRAS CHAVE. Disponibilidade de alimentos, *Syagrus romanzoffiana*, Serra do Espinhaço.

Sciurus ingrami Thomas, 1901 is the only sciurid species in Brazilian Atlantic Forest, where it is present from Bahia State (South-eastern Brazil) to Rio Grande do Sul State (South Brazil) (EMMONS & FEER 1990). Few studies are available concerning the behaviour and ecology of these animals (MAIA *et al.* 1987, GALETTI *et al.* 1992, PASCHOAL & GALETTI 1995, BORDINHON & MONTEIRO-FILHO 1999, 2000, SOUZA 2000). But, squirrel nests have been described only for the European and North American species (FITZWATER & FRANK 1944, TITTENSOR 1970, FARENTINOS 1972, YAHNER 1980, WAUTERS & DHONDT 1988, 1990, CAREY *et al.* 1997). In Brazil, MONTEIRO-FILHO & MARCONDES-MACHADO (1996) described the nest construction in nest-boxes by *S. ingrami*.

Nests are used by squirrels as resting places and shelter against bad weather, for protection against predators and for nursing the young (FARENTINOS 1972, YAHNER 1980, WAUTERS & DHONDT 1990, CAREY *et al.* 1997). The European red squirrel, *Sciurus vulgaris* Linnaeus, 1758, and members of the genus *Sciurus* Linnaeus, 1758, in North America (e.g. *Sciurus carolinensis* Gmelin, 1788, *Sciurus niger* Linnaeus, 1758, *Sciurus aberti* Woodhouse, 1853) and other tree squirrels of the genus *Tamiasciurus* Trouessart, 1880 and *Glaucomys* Thomas, 1908, use three types of dens: cavities or hollows in trees, short-duration

leaf/lichen/moss nests, and long-duration stick nests usually lined with leaves, moss, lichens, and shredded bark (FITZWATER & FRANK 1944, KOPROWSKI 1994, WAUTERS & DHONDT 1990, CAREY *et al.* 1997, MENZEL *et al.* 2003, SALSURY *et al.* 2003). Animals of the *S. carolinensis* species congregate in cavities or hollows in tree during the winter months, but with the advent of summer they again become anti-social and spread out to build leaf nests (FITZWATER & FRANK 1944). Many squirrels may congregate in dens and most species have multiple dens. It is usual, however, for females to maintain exclusive maternal dens (WAUTERS & DHONDT 1988, CAREY *et al.* 1997, MENZEL *et al.* 2003). Cavities provide shelter (from inclement weather and from predators) that is superior to the shelter provided by stick nests, but denning in nests (vs. cavities) may reflect a less energy-demanding climate and a relative lack of suitable cavities (CAREY *et al.* 1997).

In this study, a survey was made of the distribution of *S. ingrami* nests in a woodlot located in the Serra do Caraça Reserve, in state of Minas Gerais, South-eastern Brazil, in which there is a high concentration of the plant *Syagrus romanzoffiana* (Chamisso) Glassman (Arecaceae), a native palm tree considered an important food resource for this individuals (BORDIGNON & MONTEIRO-FILHO 1999, PASCHOAL & GALETTI 1995). The nest-

building behaviour and the nest characteristics, such as height from the ground, total circumference, diameter of the entrance, and the position of the nest in the tree – in the crown, along the trunk or in a side branch were described.

The Serra do Caraça Private Natural Heritage Reserve (20°05'S, 43°29'W) is located in the slopes of the Serra do Espinhaço mountainous system, in a region considered a transition zone between the Cerrado and the Atlantic Forest biomes. The reserve has 10,187 ha, with elevations ranging from 850 to 2070 m above sea level. Annual mean temperature is around 19°C, with maximum temperatures seldom reaching 30°C and minimum temperatures some times below zero. There is a climate marked by a rainy summer (October-March) and dry winter (April-September). The Reserve shows various floristic formations that include seasonal semi-deciduous forests, high-altitude fields, and rupestrian fields (grasslands surrounded by rock outcrops, as well as shrubs and small trees). The study was carried out in a woodlot of 4 ha area, having native semi-deciduous trees with little undergrowth and located near to the Reserve's headquarters, where there is an abundance of *S. romanzoffiana* among other exotic tree species, such as *Cupressus* sp. (Cupressaceae) and *Quercus* sp. (Fagaceae), and an area in which tourists are constantly present.

During a period of April to November, 2001, fifteen individuals, eight females and seven males were studied. Captures were made between February and April, 2001. The squirrels were trapped using twelve live-traps (galvanized wire cages measuring 15 x 15 x 32 cm) in the areas most frequently used by the animals. These traps were opened during two days each month, between 6 a.m. and 6 p.m. The baits used were *S. romanzoffiana* fruits or peanuts. The individuals were marked using plastic collars with two coloured beads: one colour for sex identification and the other for individual identification. There were captures of two young individuals of unknown sex. These individuals were not marked. The marking and release of the squirrels occurred as soon after captures as possible. The use of anaesthetic was not necessary during handling of the animals.

The behaviour of the squirrels was investigated in nine observation points in the study area. In each month a set route for making observations was travelled during 6 days to ensure that all nine points were sampled at all times of day. The observations were made using 8-17 x 25 mm binoculars: between 6:00 a.m. to 6:00 p.m. The localized nests were measured for total circumference and diameter of the opening. Height from the ground was also measured using a 50 m measuring tape.

Altogether, eighteen nests were localized during the period studied. The area with the highest concentration of nests was a small tract (100 m) of woodland along the Rio Caraça, in which eight nests were found. The nests were built in *Cupressus* sp., *Quercus* sp., *Lafoensia pacari* A. Saint Hilaire (Lythraceae), *Dicksonia sellowiana* Hooker (Dicksoniaceae), among other tree species. A total of 105 *S. romanzoffiana* trees was identified in the area of distribution of these nests. The majority of the nests

was built on multiple branches in the middle of the tree crowns, except one of them was built in the upper crown of *D. sellowiana* (a tree fern species) and other was built on a trunk fork of *Cupressus* sp. The nest height averaged 7.4 m (SD = 1.7, N = 18) and varied from a maximum of 10 m to a minimum of three meters. The nest circumference averaged 55.8 cm (SD = 8.7, N = 18). Maximum and minimum nest circumference were 70 cm and 40 cm, respectively. The diameter of the opening was approximately five centimetres for all nests.

The eighteen nests had a globular shape and only one entrance. They consisted basically of an agglomerate of twigs, leaves, moss and fibres taken from tree trunks. The inner chamber was formed of fibres from the trunk of *Cupressus* sp. These were removed by the squirrels with the teeth, wound up with the paws and arranged with the muzzle into a hollow ball, which was then carried up in the mouth to the site of construction. The inner chamber was a compact, oval-shaped structure of closely woven fibres, with an outer shell built of other materials. No nests were observed in tree cavities.

A adult male, a sub adult male, four adult female and a young squirrels were observed building nests in the months June, July, September and October, 2001. A adult male squirrel was observed removing fibres from the trunk of a *Cupressus* sp. tree and repeating this behaviour two months later. Nest utilisation was little observed, yet squirrels entering and leaving a nest were more frequently observed at daybreak (beginning of activity) and late afternoon (end of activity). A subadult male squirrel was seen entering three different nests at different times of the year. In October the presence of a juvenile squirrel inside a nest was recorded. In September and October five adult females with evidence of reproduction (e.g., large nipples and lactation) were recaptured, indicating a reproductive season.

The nests built in trees were similar to those described for European and North American squirrels and the nest building behaviour was in agreement with that reported by FARENTINOS (1972) for *Sciurus aberti*. This author reported that the average height of the nests built of *Pinus* sp. leaves was 10.7 ± 1.6 m, greater than the average value found in our study. HACKETT & PAGELS (2003) found that Carolina northern flying squirrel, *Glaucomys sabrinus* (Shaw, 1801), used a variety of nest trees and generally chose larger and taller trees than was available. In the Pacific Northwest USA, CAREY *et al.* (1997) found den sites of northern flying squirrel in cavities, stick nests, and moss nests in live and dead old-growth trees, but two-thirds of all dens located were in tall live trees (large and medium conifers). They suggested that live trees may be more suitable as nest sites because overhead branches provide extra protection from weather, and protection from predators in the form of cover and escape routes; thus it is tree crown height that most likely determines nest height.

In the nests studied the opening leading from the inner chamber to the exterior was very small and can hardly be seen, affording added protection against invaders. In our study area, the probably predators were identified as including snakes,

tayra, coati and the hawk *Milvago chimachima* (Vieillot, 1816).

The large concentration of nests near to the Reserve's headquarters, where there is the largest concentration of *S. romanzoffiana*, may be related with the characteristics of the site, i.e., presence of tall trees and availability of food resources. The food availability appears to be an important factor in the animals' choice of this site, especially *S. romanzoffiana*, the fruits of which represent 70% of the diet of the squirrels (C.A. Alvarenga, unpublication data). Anthropogenic items (bread, popcorn, cake, peanuts) constitute the second most important food category in our study area, accounting for 14% of the diet. These items are frequently supplied to the animals by the administrators of the Reserve.

According to CAREY *et al.* (1997), the capability to build nests close to foraging areas, particularly with ephemeral and rapidly harvested (e.g. nuts and seeds) foods, reduces energetic costs of travel and risk of predation. Furthermore, WAUTERS & DHONDT (1989) found that lactating females, because they can not leave their nests to search for food, have to optimise their foraging, activity and space use patterns in order to meet their energy needs during lactation. Thus, the greater concentration of *S. ingrami* nests in an area of the Reserve containing more abundant food resources can be an adaptive pattern in the reproductive effort of this population, aimed at expending less energy in searching for food during the period of reproduction and development of the young.

The denning appear to be a complex occurrence composed of a array of behavioural aspects that included social, energetic, predator, parasite avoidance, and food resources (CAREY *et al.* 1997, BAKKER & HASTINGS 2002). Thus, future research should focus on this unexplored topic for this Neotropical rodent.

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