Revista de Etologia 2002, Vol.4, N°2, 109-116

A Behavioral Description of Captive Young Capuchin Monkey (*Cebus apella*)

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We describe 21 behavioral categories of young captive *Cebus apella* monkey, observed from January to May 1996, during 90 hours, in two islands with bushy meadow vegetation at the Zoological Sector of Iguaçu Municipal Park (Southern Brazil). Six feeding behavior categories were described, including the use of tools of the hammer-and-anvil type to obtain food and of probes to locate ants. Nine play categories and five contact categories were described, including copulations between adult and young animals that may have a social function. A single alert category was recorded, it occurred in situations in which the whole groups was involved. High frequency of play behavior of young monkeys might constitute a preparation for the adult stage of development.

Index terms: Development. Play, tool use. Body contact. Capuchin monkeys. *Cebus apella*.

Uma descrição comportamental de jovens de macaco-prego (*Cebus apella*) em cativeiro. Este estudo traz uma descrição de 21 categorias comportamentais de jovens macacos-prego, observados durante 90 horas, de janeiro a maio de 1996, no Setor zoológico do Parque Municipal do Iguaçu, em duas ilhas cobertas por gramíneas e vegetação de várzea de porte médio. Foram descritos seis categorias de comportamento alimentar, incluindo o uso de ferramentas do tipo martelo-bigorna e de estiletes; nove categorias de brincadeira; cinco categorias de comportamento de contato, incluindo cópulas entre jovens e adultos com possível função social. Foi descrito apenas um comportamento de alerta, exibido em atividades nas quais a maioria do grupo estava envolvida. Supõe-se que os freqüentes comportamentos de brincadeira dos jovens constituam uma preparação para a fase adulta.

Descritores: Desenvolvimento. Brincadeira, uso de ferramentas. Contato corporal. Macacos-prego. *Cebus apella*.

Monkeys from the genus *Cebus* are arboreal primates of middle-height and robust body with semi-prehensile tails used to carry little objects and employed for support during tree progress (Freese & Oppenheimer, 1981). They have a wide geographic distribution, occurring from Mexico to North Argentina (Freese & Oppenheimer, 1981) and are considered the most cognitively competent primates of America because of their ability to use tools to obtain food (Auricchio, 1995).

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A version of this paper was presented at the XV Encontro Anual de Etologia. We thank the Zoological Sector of Iguaçu Municipal Park, the Paraná Federal University, UFPR, the Brazilian Ethological Society (SBEt), Mr. Brasilio Serbena and Mrs. Iris Boff for financial support and the lending of equipment. We are grateful to Francisco Serbena, and Márcia Cordeiro for help with the English of this article, to Dr. Marcelo Aranha and Dr. Rogério C. Lange for their critical comments to the initial version of the paper and especially to Eduardo B. Ottoni for valuable suggestions and for references. We also thank the anonymous reviewer for his/her comments.

In primates, adolescence is recognized as a distinct developmental period during which there are slow transformations in morphology, physiology and behavior (Pusey, 1990). Young individuals are characterized by their lack of plainly developed secondary sexual characters and by the smaller size of their body (Pusey, 1990).

Knowledge of the social and reproductive behaviors of captive animals is essential for the management of reproduction (Santos, 1991). Constant integration between the field and captive results is thus required (Yamamoto, 1991). Studies which open a better understanding of the social behavior of primates are important tool for the preservation of species and their habitats (Carrol, 1991). In this study, we describe the behavior of young *Cebus apellus* of a captive group, distinguishing it from infant and adult behavior.

Method

The study was performed at the Iguaçu Municipal Park, Zoological Sector, located in the border between the city of Curitiba and São José dos Pinhais, Paraná State, South Brazil. The zoo is located in an area of mixed ombrophyla forest, with arboreal species *Araucaria angustifolia* and meadow vegetation of a river (Rio Iguaçu). The climate is the type *Cfb*, with fresh summer, frequent frost, no dry station, with average temperatures between 22º C in hot months and lower 17º C in cold months (Fundo Nacional de Meio Ambiente, 1996). The rains are between 1300 mm and 1500 mm, with relative humidity of 85%, hidric index between 60 and 100 and with no hidric deficiency (Fundo Nacional de Meio Ambiente, 1996).

The monkeys' enclosure had two oval islands distant five meters one from another and ten meters from the bark. One of them was about 8 x 5 m, the other one 4 x 10 m. In the bigger island there was mainly bushy meadow vegetation and a little grass field subject to seasonal flooding. The smaller island has grass fields as a major part of it and some short bushy vegetation.

Observations were made from January to May 1996, three to four hours a day, two or three days a week, always in the afternoon. During rainy days, observation time was reduced because of the slowing of activity of the young monkeys.

An *ad libitum* observation technique (Altmann, 1974) was initially used to identify the behavioral repertoire of young individuals. Once the differences in behavior between young and adult behavior was distinguished, a sequential sampling technique (Lehner, 1979) was used for a more detailed behavioral description.

The behaviors here sampled for description were those of young individuals, intermediate in size between infants and adults, without secondary sexual characters, and able to remain by themselves.

Results

90 hours of observation were performed, during five months of study. Total number of individuals observed varied because monkeys were eventually moved or got out of captivity.

The behaviours were classified into four types: feeding, playing, contact and alert behaviors.

Feeding

Ant catching. In crouched posture, head down, the individual pulled out pieces of soil with both hands. sometimes using the fingers. Pieces of soil with grass were then pulled out and sorted. When some ant was located, the monkey held it between the fingers and took it to the mouth. Searching was resumed after the ingestion of the food.

Feeding on grass. Crouching over the grass, the monkey pulled leaves of grass with both hands until snapping them off. The leaves were then taken to the mouth, fixed between the teeth and pulled out with both hands. This performance exposed a white stem that was eaten.

Beating with hands. Sitting down with a rigid exocarp fruit in the hands, the animal knocked it several times in the ground with a single hand. After attempting to open the fruit, the animal bit it and repeated this knocking behavior. Knocking food on the ground was sometimes performed from a bipedal position, as hammer-anvil behavior, but without tools.

Fly catching. When the animal perceived the presence of a fly, ongoing activity was stopped and fast hand movements were performed in an attempt to catch the fly. The monkey, most of the times, tracked the fly that flied away. Other monkeys were eventually attracted and performed the same behaviors, without interaction among themselves.

Feeding (with tool)

Hammer-and-anvil. A big rock, a root or a half-buried piece of cement were used as an anvil, and supported the food. A second small rock was used as a "hammer" to knock the food, in an attempt to open it. These tools were utilized on peeled oranges and papaya too.

Probe. Crouching over the grass, the monkey took a fagot and started to revolve the ground with its extremity (Figure 1). During this behaviour, pieces of soil were taken out and the fagot was put into the mouth to be licked. After licking, the monkey exposed the tongue several times and moved the head laterally. The fagot was afterwards used again in the same way.

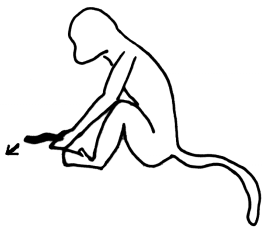

Figure 1. Capuchin monkey using a "probe" on the ground to feed on ants.

Social play

Fighting. This behavior varied according to context of performance and involved two or more individuals. When playing on the ground, two monkeys stayed face to face in a crouched posture. One of them jumped above the other trying to hold it by one of the limbs. This behavior was repeated, if unsuccessful. In case of fulfillment, animals firmly grasped each other, rolling and inverting occasionally their positions. Biting was frequent during such episodes. When interaction occurred in the trees, both monkeys hung their bodies by the tail and one of them attempted to grasp the other monkey's limb (Figure 2A).

Chasing. Two young started a fight until one of them ran away. The other one chased the partner and when near from him, attempted to grasp the legs in order to knock it down. Going up and down a tree could be part of this activity.

Tug-of-war. A young monkey, crouching, found and handled a stem. A nearby juvenile came into its direction. They initially sat down, with the stem between them. Each one then grasped one extremity of the stem with both hands and pulled it as in a tug-of-war play (Figure 2B). When one of the animals left the stem, the other one followed and initiated a fight or a chase.

Pulling the tail. A crouched juvenile grasped another one by the tail. The monkey tried to free itself by going in the opposite direction or turned round to start of fight (Figure 2C).

Grabbing. A crouched young monkey seized another by the back in the pelvic region (Figure 2D). The restrained monkey attempted to set free by shaking its body laterally, by trying to assume a bipedal posture or by biting the opponent. After grabbing, a fight could be started.

Slipping down in a spiral. This behaviour was usually performed during chasing. Two monkeys playing chase on a tree positioned themselves in the main trunk to get down, slipping to the ground. They held the stalk with hands down and legs up and went down in spiral movements (Figure 2E).

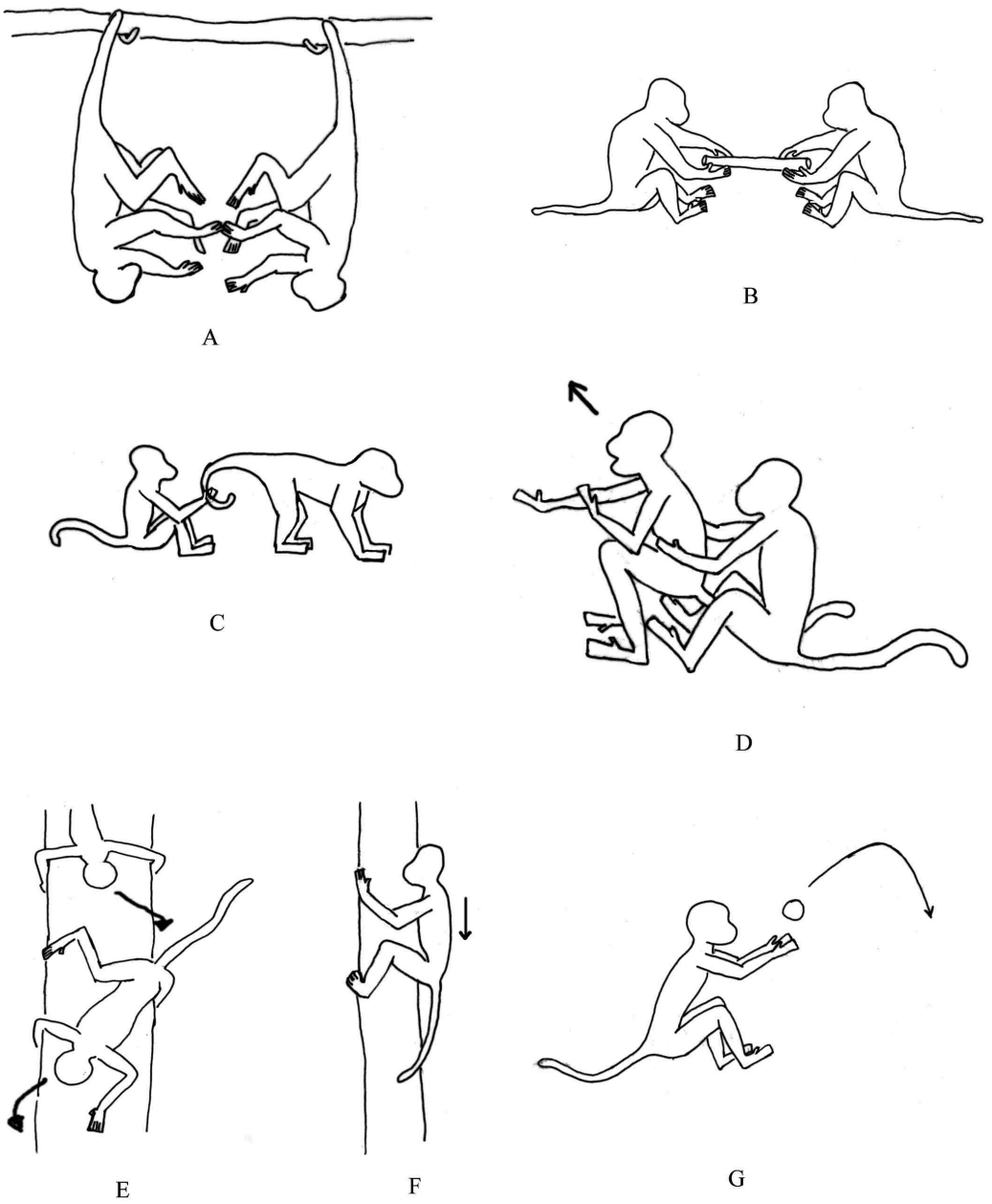

Figure 2. Play behavior of *C. apella*. A: fighting with body hanging by the tail, B: tug-of-war, C: pulling the tail, D: grabbing, E: slipping down in a spiral, F: slipping, and G throwing up.

Solitary play

Slipping. Monkeys got down from trees by slipping. They went to the trunk, seized it with arms and slipped to the ground. (Figure 2F).

*Somersault.*A crouching monkey rolled in a circle from front to behind on an imaginary horizontal line as a somersault. Usually, the jump was not complete and attracted other young to play.

Throwing up. The monkey in a crouched position threw up a piece of food, following it with the gaze until it fell on the ground. (Figure 2G). Throwing up was repeated several times before the animal ate the food.

Contact

Contact behavior was characterized as the relatively lasting touch of body parts of two monkeys.

Ventral-dorsal contact. Two monkeys, very near from each other, were both performing the ant catching category. One of them (*a*) approached and sat down behind the other (*b*), belly of monkey *a* touching the back of monkey *b* (Figure 3A). The arm of *a* was then positioned on the waist of *b*, which continued to perform the ant catching category.

Contact in a resting posture. A monkey lied over the body of another monkey, which was in

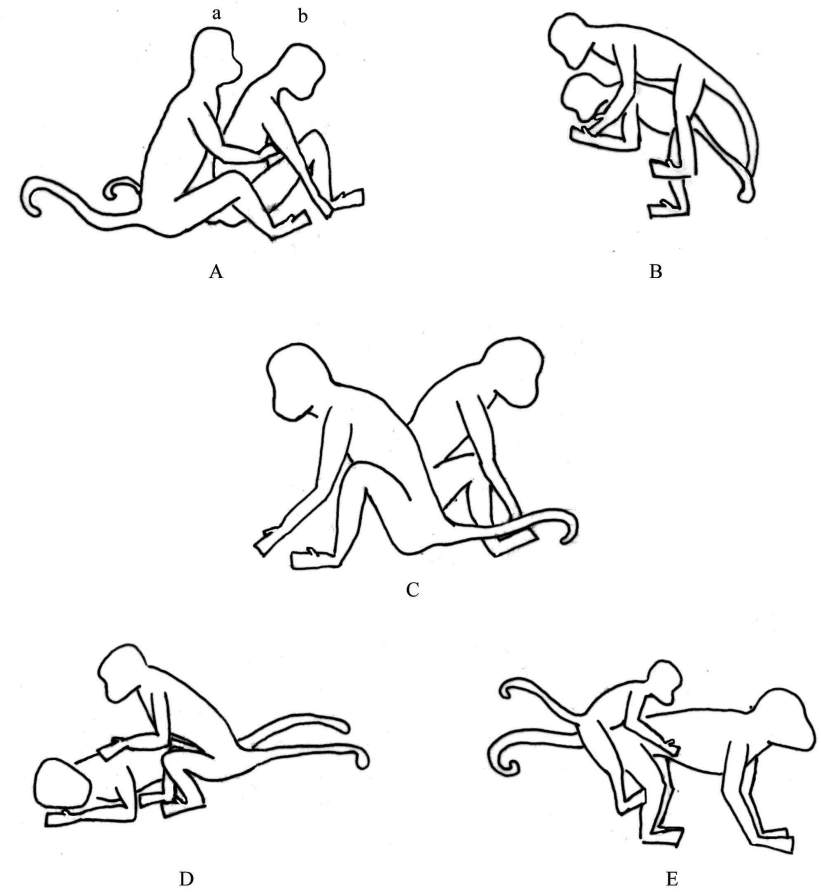

Figure 3. Contact behaviors of *C. apella*. A: ventral-dorsal contact, B: contact in a resting posture, C: contact during feeding, D: adult-young copulation and E: young-adult copulation.

a resting posture, putting arms, legs, tail, back or belly in contact (Figure 3B). The pair remained in contact for a relatively long time.

C*ontact during feeding*. While feeding in a crouched posture, two individuals got gradually near one another throughout little movements until they touched each other. Tails eventually touched (Figure 3C).

Adult-young copulation. An adult monkey approached two play fighting juveniles and participated of the play episode. When one of the young monkeys moved away, the other one placed its anal area near the adult's genital area. The adult then grasped the young by the waist and initiated copulatory movements (Figure 3D). The young while lying moved its body a lot, exhibiting changes in facial expressions, sometimes turning and facing the adult.

A young capuchin was once observed crying, after interacting agonistically with an adult. Another nearby adult approached and performed copulatory movements with it. The young immediately stopped crying and began playing.

Young-adult copulation. After an episode of adult-young copulation, a young individual could rise and mount an adult that was in a quadrupedal posture. The young climbed on the heels of the adult, grasping with the hands the pelvic region (Figure 3E). The copulatory movements were then performed, the adult staying still until the end of the episode. The young then interacted agonistically with the adult or performed a solitary activity. Distance did not allow the observer to discriminate the sex of the young animals.

Alert posture

A young capuchin approaching vocalizing monkeys placed its tail in an "S" position, while standing on four legs (Figure 4). The young placed itself behind adults, and remained in this "alert" posture until the end of the episode and the dispersal of all individuals. The tail was only seen in an "S" position in situations in which some individuals were crying or in which most individuals of the group were involved in a single event. In normal situations the tail was kept rolled under of the spine line.

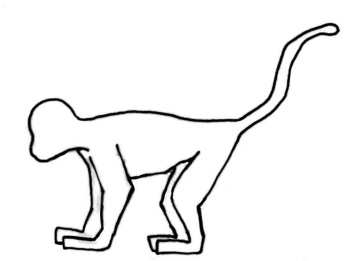

Figure 4. Alert posture of *C. apella*. The tail is above the back line and has a typical "S" form.

Discussion

Foraging on insects (mainly ants) was a frequent activity among young capuchins, performed as ant and fly catching. Izawa (1979) observed similar foraging activities when termites were a common item in the diet of *C. apella*. M. Aranha (personal communication) suggested that fly catching be included among play categories, due to the lack of effectiveness of this behavior for feeding.

The use of tools to get food is an indication of capuchins capacity to perform elaborated behaviors. Anderson (1990), Izawa and Mizuno (1977), Ottoni and Mannu (2001), Resende and Ottoni (2002) and Rocha (1995) observed the hammer-and-anvil type of behavior. In Izawa and Mizuno (1977) study, a bamboo knot was used as a substrate. Ottoni and Mannu (2001) hypothesized that occurrence of this behaviour depends of factors such as: predation risk, kind of vegetation, food availability or social relationships (as the restriction of access to food in juveniles due to dominant adult monopoly). The hammer-and-anvil category was observed both in adults and young individuals. Young eventually used peeled oranges and piece of papaya as items to be crushed, when there was no need of tool use. An age difference in efficiency of tool use may exist but it was not quantitatively detected in this study.

Tool use depends probably on learning. Anderson (1990) and Izawa and Mizuno (1977) observed that young *C. apella* learned this kind of behavior by observing adults. Izawa and Mizuno (1977) considered that utilization of tools is a behavior with a high adaptative value in the habitat of these monkeys, as is the case with similar behaviors performed by wild chimpanzees. Ottoni and Mannu (2001) realized detailed quantitative observations in semi-free ranging capuchins (*C. apella*) and reported that the episodes of tool use for nut-cracking by adults was observed by other individuals (infants and juveniles) and that the rate of inept manipulation decreased with age, indicating learning by juveniles.

In captivity, there were scattered branches and rocks and these were used frequently by both young and adults. This situation contradicts the observation of Anderson (1990) who suggested that the use of branches as hammers constituted a condition for a developmental change bringing the use of rocks as hammers, when branches were taken off. The use of rocks and trunks as hammers is probably a behavior that occurs depending of the availability of these tools.

The behavioral category with "probe" was used in a different context, helping juveniles to dig the ground to catch ants. When performing this behavior the monkey exposed its tongue, probably because of ant bites. This category constitutes a novel form of tool use by capuchin monkeys.

Play behaviors were the most variable of all categories here described. Young individuals possibly develop, through the performing of such activities, their motor coordination and learn about force, ability and temperament of younger and older individuals. Play helps to establish social relations inside the group, as suggest by Freese and Oppenheimer (1981).

In play episodes between young and adults, no agonistic confrontation was observed and sometimes episodes resulted in copulation. Copulatory episodes apparently serve to establish specific social bonds from adolescence on. Social play is important in the establishment of social relationships in the members of a group, increasing the tolerance between the individuals and facilitating the learning of tool use (Resende & Ottoni, 2002).

Apart from social play, solitary play behaviors were perfomed by capuchins. According to Freese and Oppenheimer (1981) these behaviors help monkeys to learn about the environment, promoting physical coordination and confidence in locomotory abilities. Resende and Ottoni (2002) denominated object play behavior as exploratory manipulation, once it was difficult to distinguish it from manipulation. The throwing up category may be included in the exploratory manipulation class of behaviors. The other play categories – slipping and somersault – may correspond to play activities correlated to improvement of physical activity.

The ventral-dorsal contact occurred mainly in peaceful situations, generally during ant catching performance. Freese and Oppenheimer (1981), however, described the occurrence of a similar behavior in agonistic situations which was called "overlord" behavior, serving to increase the threat against a third individual in wild capuchins.

Observation of the interlinked adult-young and young-adult behaviors make us to suppose that copulatory behavior has appeasing effects on agonistic relationships. According to Freese and Oppenheimer (1981), sexual games in which young and subadults or adults copulate, promote social contact and, supposedly, provide sexual practice to young individuals.

Alert behavior may be a form of communication between the individuals during group situations, serving to attract attention of other group members to the occurrence of some event.

Our study shows that the behavior of young *C. apella* differs from adult behavior by the higher frequency of play, which could be interpreted as a training of adult behaviors. This developmental period, rich in behaviors, should constitute an interesting subject for future research.

References

Altmann, J. (1974). Observational study of behavior: Sampling methods. *Behaviour, 4,* 227-267.

Anderson, J. R. (1990). Use of objects as hammers to open nuts by capuchin monkeys (*Cebus apella*). *Folia Primatologica, 54*, 138-145.

Auricchio, P. (1995). *Primatas do Brasil*. São Paulo: Terra Brasilis Press.

Carrol, J. B. (1991). The captive breeding of the genus *Callithrix* at the Jersey Wildlife Preservation Trust. Em A. B. Rylands & A. T. Bernardes (Eds.), *A primatologia no Brasil - 3* (pp. 17-23). Belo Horizonte, MG: Fundação Biodiversitas.

Freese, C. H., & Oppenheimer, J. R. (1981). The capuchin monkey, genus *Cebus*. Em A. F. Coimbra-Filho & R. A. Mittermeier (Eds.), *Ecology and Behaviour of Neotropical Primates 1* (pp. 331-390). Rio de Janeiro: Academia Brasileira de Ciências.

Fundo Nacional de Meio Ambiente. (1996). *Nossas árvores: Manual para Recuperação da Reserva Florestal Legal*. Curitiba, PR: Sociedade de Pesquisa em Vida Selvagem e Educação Ambiental.

Lehner, P. N. (1979). *Handbook of ethological methods*. New York: Garland STPM Press.

Izawa, K. (1979). Foods and feeding behavior of wild back-capped capuchin (*Cebus apella*). *Primates, 20*(1), 57-76.

Izawa, K., & Mizuno, A. (1977). Palm-fruit cracking behavior of wild black-capped capuchin (*Cebus apella*). *Primates, 18*(4), 773-792.

OtToni, E. O., & Mannu, M. (2001). Semifree ranging tufted capuchins (*Cebus apella*) spontaneously use tools to crack open nuts. *International Journal of Primatology, 22*(3), 347-358.

Pusey, A. E. (1990). Behavioural changes at adolescence in chimpanzees. *Behaviour, 115*(3-4), 203-246.

Resende, B. D., & Otonni, E. B. (2002). Brincadeira e aprendizagem do uso ferrramentas em macacos-prego (*Cebus apella*). *Estudos de Psicologia, 7*(1), 173-180.

Rocha, V. J. (1995). *Dieta, ação sobre as sementes, padrão de atividade e área de vida de* Cebus apella *(Linnaeus, 1758) em três fragmentos florestais de tamanhos distintos na região de Londrina - PR*. Dissertação de mestrado, Departamento de Zoologia, Setor de Ciências Biológicas, Universidade Federal do Paraná, Curitiba, PR.

Santos, C. V. (1991). Estudo comparativo do desenvolvimento comportamental de filhotes de calitriquídeos nascidos no Centro de Primatologia do Rio de Janeiro - FEEMA. Em A. B. Rylands & A. T. Bernardes (Eds.), *A primatologia no Brasil - 3* (pp. 35-46). Belo Horizonte, MG: Fundação Biodiversitas.

Yamamoto, M. E. (1991). Comportamento social do gênero *Callithrix* em cativiero. Em A. B. Rylands & A. T. Bernardes (Eds.), *A primatologia no Brasil - 3* (pp. 63-81). Belo Horizonte, MG: Fundação Biodiversitas.

Received August 15, 2002
Revision received February 01, 2003
Accepted february 17, 2003