

Behavior of male and female eclectus parrot (*Eclectus roratus*) in an artificial environment

Eduardo Cesario Araújo Martínez¹, Vanair Carlos Paz² and Rodrigo Diana Navarro^{1*}

¹Faculdade de Agronomia e Medicina Veterinária, Universidade de Brasília, Caixa Postal 4508, 70910-970, Brasília, Distrito Federal, Brasil. ²Vanair Aves Breeder, Brasília, Distrito Federal, Brazil. *Author for correspondence. Email: navarrounb@gmail.com

ABSTRACT. The eclectus parrot (*Eclectus roratus*) is a species of parrot native to the Solomon Islands, Sumba, New Guinea and nearby islands, northeastern Australia, and the Moluccan Islands. The wide range of behaviors emphasizes the existence of knowledge of only a mere fraction of the significant behavioral parameters of these birds. The objective of this study is to identify the behavior of the eclectus parrot kept in captivity and to check the frequency of these birds in certain places of the nursery, comparing the results to other studies about parrots and the behavior in nature. This is a study about the behavior of a bird with a very pronounced sexual dimorphism, where the males have a predominantly green color, and the females are mainly red-colored. In the wild, while the male perches on the outer branches of the trees, the female usually perches close to tree trunks. This location, together with her red and blue plumage, provides the ideal camouflage in the dark interior of the trees.

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Introduction

Eclectus parrot (*Eclectus roratus*) is a species of parrot native to the Solomon Islands, Sumba, New Guinea and nearby islands, northeastern Australia, and Moluccas Islands. The name Eclectus is derived from the word eclectic, due to the sexually dimorphic coloration. This parrot is the most characteristic example of sexual dimorphism among birds. In fact, for many years, biologists believed that these birds were two different species. Males predominantly have feathers with bright shades of emerald green. The body sides and the bottom of the wings is reddish, with a blue touch on the wings and tail. The top of the beak is orange with a yellow tip, and the bottom of the beak is black. The plumage of females is generally reddish, and the abdomen, the lateral of the body, the lower part of the chest, and the nape are violet-blue, with the upper and lower part of the beak being black. (Heinsohn & Legge, 2003).

The eclectus parrot belongs to the order Psittaciformes and has an average size of 31 to 37 cm in length. Psittaciformes can be distinguished from other birds through morphological characteristics, such as beaks with curved jaws, zygodactyly (two pairs of opposing fingers), and prehensile tongue (Forshaw & Knight, 2010). The existence of more than 300 psittaciform species and their wide variation in behaviors emphasizes the existence of a mere fraction of the significant behavioral parameters of these birds (Lighfoot & Nacewicz, 2006). Moreover, the parrots of this order have a high degree of conservation concern (Snyder, McGowan, Gilardi, & Grajal, 2000) since they are fruit and seed predators heterogeneously distributed in space and time (Renton, 2001). For this reason, their behavior probably reflects the adaptations in response to these fluctuations in resource distribution (Salinas-Melgoza, Salinas-Melgoza, & Wright, 2013).

The variability in resource availability is a factor affecting movement patterns and habitat preferences of animals (Renton, 2001). Behavioral plasticity is a strategy employed by many species to deal with natural to human-mediated variability. Understanding the response of animals to these resource fluctuations has assumed a new urgency with the widespread and severe changes in the environment caused by human activities (Salinas-Melgoza et al., 2013).

According to Snyder et al. (2000), Psittaciformes are one of the most threatened bird groups. With the decimation of habitats around the world, captive breeding of many species became the way to ensure their survival (Lighfoot and Nacewicz, 2006). Parrots have been kept in zoos, residences, and laboratories for conservation, companionship, and research purposes. However, the intelligence, longevity, and behavior of

parrots raise concerns to maintain them in these environments since they end up limiting their expression of usual behaviors and, consequently, developing abnormal behaviors (Rodríguez-López, 2016).

Ensuring adequate well-being in captivity is not an easy goal. The lack of environmental needs, such as social interaction, can cause critical illnesses and abnormal and self-injurious behaviors. That occurs because, in nature, parrots exploit their cognitive and physical abilities to adapt to their dynamic environment. However, in captivity, the food resource and nesting place is easily accessible and always available, besides the lack of predators and limited space and complexity (Luescher, 2006). In this case, environmental enrichment can help reduce these behavioral problems, as well as provide the animal with opportunities to perform its normal behavior and cope with its captive living environment (Swaigood & Shepherdson, 2005).

The lack of information on behavioral problems is the main concern of avian veterinarians, making it difficult to diagnose and treat captive birds. Moreover, Psittaciformes is the main order involved with such behavioral complaints. More than half of the psittacine cases presented to veterinarians have behavioral problems inherent in captive birds (Luescher, 2006).

This research aimed to identify the behavior of the eclectus parrot in captivity and check the frequency of these birds in certain nursery spots, comparing the behavior to other studies about psittacines and the behavior in nature.

Material and methods

The work was carried out in the Vanair Bird Breeding farm, located in Planaltina, Federal District, Brazil (15°38'25"S, 47°41'7"W). Ibama authorization No. 9999.7575/2013-DF. Annotations were manual on a table, with 43 observations of three couples of eclectus parrots every two minutes (Figures 1, 2 and 3) for one hour each day, for three months. The breeder has a total of approximately two thousand birds, all parrots, such as Australian parakeets, cockatiels, Congo parrots, ringneck parrots, king parrots, and eclectus parrots. The total area of the nursery is 5,000 m², with most of the external areas. There are fruit trees, and practically the entire terrain is grassy, which gives a higher relative humidity to the region, which is famous for its aridity, especially in the winter season. The average temperature during the analysis period was 25.86°C, according to data from the National Institute of Meteorology. Each nursery (Table 1) is screened and has masonry around. They measure 3.5 m long, 1.5 m wide, and 2.1 m high. The nest is made of wood and shaped in L, and has the following measures: 1 x 0.9 m x 0.45 m x 0.45 m.



Figure 1. Male parrot eclectus (*Eclectus roratus*).

Source: The authors.



Figure 2. Female parrot eclectus (*Eclectus roratus*).

Source: The authors.



Figure 3. Enclosure structure.

Source: The authors.

Table 1. Description of the various sites in the nursery.

Place	Description
External Grille	Structure of braided wire
Right Grid	Structure of braided wire
Left Harrow	Structure of braided wire
Superior Grill	Structure of braided wire
Internal Grille	Structure of braided wire
Internal Pole	Structure made of tree branch
External Pulley	Structure made of tree branch
Right Masonry	Structure made of bricks and cement with fine finish
Left Masonry	Structure made of bricks and cement with fine finish
External Masonry	Structure made of bricks and cement with fine finish
Wire	Metal structure
Internal Masonry	Structure made of bricks and cement with fine finish
Rope	Structure made of cotton
Chain	Structure made of metallic material
Floor	Structure with ceramic finish
Inner Nest	Structure made of wood, L-shaped, with sawdust inside
Upper Nest	Structure made of wood, L-shaped
Food/Water Countertop	Structure made of wood, containing metal plates for feed

Results

Table 2 shows the mean frequency (%) of time the birds stayed in certain places in the nursery. During the observation period, the male remained in the external grid for a longer period (11.43%) than the female (0.50%). The right grid was more frequented by the female (3.42%) than by the male (3.36%), but for a short period. The left grid, on the contrary, was more frequented by the male (1.81%) than by the female (0.19%), but also for a short period. The upper grid was more frequented by the male (4.03%). Neither the male and female attended the internal grid, with only 0.17% and 0.47% of the time, respectively. The internal perch was quite frequent by both the male (24.43%) and female (18.81%). The external perch was also quite frequent by both the male (33.95%) and female (16.27%). However, we found a higher frequency of the male in the internal and external perches. The right masonry was poorly frequented by the male (0.39%) and female (0.14%). The right masonry was frequented only when both male and female were in the feed/water

table or when the female was in the nest. The left masonry was less frequented by the male (0.18%) and the female (0.2%) because it lacked the nest and the feed/water table. The external masonry was poorly frequented by the male (0.20%) and only once by the female (0.00%). The wire was rarely frequented by the male and female, in which they remained only 0.07% and 0.02% of the time, respectively. The same occurred in the internal masonry, where both the male (0.04%) and female (0.02%) stayed for a short period. The rope connecting the internal perch to the external perch was more frequented by the male (9.18%) than by the female (0.30%). The male and female remained for a short period in the chain, with 0.78% and 0.02%, respectively. Both the male and female were barely seen on the floor (0.02%). The female spent 46.52% of its time in the internal nest, while the male was not once seen inside the nest (0.00%). The female stayed only 0.96% and the male only 0.71% of the time in the upper part of the nest. The feed/water table was frequented by the male 9.15% of the time, while the female stayed there for 11.86% of the time (Figure 4).

Table 2. Average of the frequency of male and female of *Electus roratus* in the different sites of the nursery.

	Male (%)	Female (%)
External Grille	11.43 ± 16.52	0.50 ± 0.86
Right Grid	3.36 ± 2.10	3.42 ± 2.61
Left Harrow	1.81 ± 1.92	0.19 ± 0.33
Superior Grill	4.03 ± 6.08	0.38 ± 0.66
Internal Grille	0.17 ± 0.13	0.47 ± 0.76
Internal Pole	24.43 ± 5.11	18.81 ± 11.88
External Pulley	33.95 ± 21.18	16.27 ± 19.95
Right masonry	0.39 ± 0.33	0.14 ± 0.24
Left masonry	0.18 ± 0.21	0.02 ± 0.04
External Masonry	0.20 ± 0.28	0.00 ± 0.00
Wire	0.07 ± 0.07	0.02 ± 0.04
Internal Masonry	0.04 ± 0.07	0.02 ± 0.04
Rope	9.18 ± 15.61	0.30 ± 0.53
Chain	0.78 ± 0.39	0.02 ± 0.04
Floor	0.02 ± 0.03	0.02 ± 0.04
Inner Nest	0.00 ± 0.00	46.52 ± 43.00
Upper Nest	0.71 ± 0.27	0.96 ± 1.34
Food/Water Countertop	9.15 ± 1.08	11.86 ± 8.06

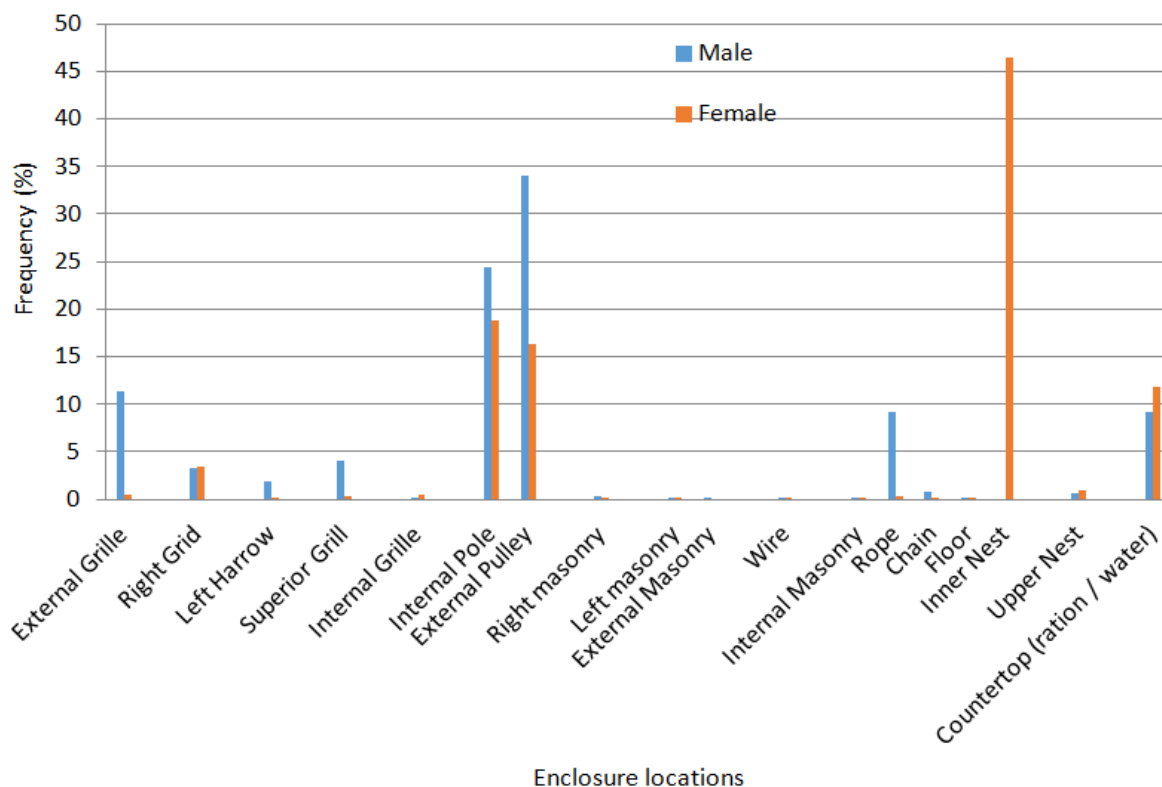


Figure 4. Graphical representation of the male and female frequency in the enclosure spots.

Discussion

The results show that the male remained longer in the external grid than the female. Males tend to forage in the canopy of trees for several hours, while females only display this behavior before nesting and feeding on the non-mating period (Heinsohn, Legge, & Endler, 2005). The external grid, being the outermost part of the nursery, can be compared to the canopy of trees, and therefore, it is a place where the male, in an artificial environment, should be found more frequently.

The female probably frequented more the right grid due to the easy access to the nest. Thus, it is natural that the female would use this site more frequently. According to Heinsohn and Legge (2003), males display an overprotection behavior during the mating period. Therefore, the male probably frequented the right grid to protect the female.

Both the male and female often frequented the internal perch, with a higher permanence frequency of the male. This internal perch promotes easy access to the nest entrance and the feed/water table, which can explain the high permanence of both at this location. Besides, the internal perch allows the male to watch and feed the female and its offspring, since the female spends most time inside the nest, just as it does in nature (Van Zeeland, Schoemaker, Ravesteijn, Mol, & Lumeij, 2013).

The male also frequented more the external perch and the rope connecting the internal and external perches. This behavior is similar to what occurs in nature, because the male, according to Endler (1978), for having a greenish plumage, prefers to stay in the outermost parts of the trees, where their plumage camouflage with the green of the leaves, while females remain in core areas of the tree canopy for better camouflage. Therefore, that is a reason why the female spent most of her time inside the nest, while the male was never seen there.

Dimorphism can also extend to behavior. The behavior of females varies from assertive to aggressive, while males can sometimes be timider (Pollock & Orosz, 2002). This bird species is monogamous like most parrots (Emery, Seed, Von Bayern, & Clayton, 2007) and can reproduce throughout the year. It usually lays 1 to 3 eggs and the incubation period varies from 28 to 30 days. The external masonry was seldom frequented by the male and not once by the female, just as the internal masonry was rarely frequented by both. That may occur due to their zygodactyl toes, which is a morphological characteristic not adapted to straight floors, but rather to branches and some substrates (Auersperg et al., 2015). This characteristic of this species also explains why they did not stay on the floor. Moreover, they also rarely visited the wires and chains, because the narrow surface of these places interferes with the birds' equilibrium, causing them to avoid these places.

The feed/water table was frequented by both the male and female, although the female remained longer at the site. In nature, males and females feed on almost the same frequency (Heinsohn & Legge, 2003). However, the longer permanence observed by the female may occur because the female usually feeds first than the male, and then, the two feed together (Collar, 1997). Another explanation may be the proximity of the feed/water table to the nest, where the female spent most of the time.

In nature, most parrots spend most time traveling far distances for food (Symes & Perrin, 2003). Once they arrive at a feeding site, they display a variety of search, selection, manipulation, and consumption behaviors, which can last between 4 to 8 hours per day, depending on the species (Margrath & Lill, 1985). Captive parrots, on the other hand, do not travel great distances or visit several sites searching for their food (Van Zeeland et al., 2013). As a consequence, captive parrots usually feed in less than one hour (Rozek, Danner, Stucky, & Millam, 2010). The predictability and lack of effort to acquire food in captivity limits foraging opportunities, and thus, reduces the bird's well-being due to the development of abnormal behaviors (Mason & Mendl, 1997). Therefore, the environmental enrichment is essential for captive birds (Young, 2003), because it increases the bird's activity, relieves stress, decreases boredom, and reduce or prevent abnormal behaviors, such as stereotypies and pterotillomania (Riber & Mench, 2008).

Conclusion

Although the scientific interest in parrot behavior has increased over the years, there is still a lack of knowledge about it. The increase in the behavioral knowledge of Psittacidae is crucial to guarantee the survival and well-being of these species in captivity. Although the eclectus parrot has shown high adaptability to artificial environments, it is impossible to reproduce the same behavior they have in nature.

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