Enrichment Options

Reaching out for Enrichment in Arboreal Monitor Lizards

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Introduction

Mendyk and Horn (2011) recently described an insightful foraging behavior in the black tree monitor, (*Varanus beccarii)*, in which the lizards use highly coordinated, reaching forelimb movements to extract prey from inside tree holes that are too narrow to enter with the head and jaws. Analogous to a foraging technique used by the Aye-aye (*Daubentonia madagascariensis)* to extract insect larvae from inside trees (e.g., Erickson, 1994), this behavior in the black tree monitor requires complex problem solving abilities, concentration, and fine motor coordination, thus making it a worthy candidate for exploring its application in monitor lizard husbandry as enrichment (Mendyk and Horn, 2011). This article briefly describes two simplistic enrichment devices for use in zoos and related facilities which promote extractive foraging in arboreal monitor lizards of the (*Varanus prasinus)* species complex.

Materials and Methods

Drilled tree trunk

Modifying the original experimental apparatus described by Mendyk and Horn (2011) to offer greater foraging opportunities, 15 holes of varying depths (15 to 75 mm) and diameters (13 to 50 mm) were drilled into a 13 cm thick tree trunk placed inside the terrarium of an adult male black tree monitor (Fig. 1). Some of the holes were wide enough for the monitor to insert its head into, whereas others were not. Mealworms (*Zophobas morio*), crickets, cockroaches (*Blaptica dubia*), and neonatal mice were periodically offered to the monitor by randomly placing prey items inside different holes within the trunk.

Fig. 1 Holes of varying depths and diameters were drilled into a tree trunk

Transparent acrylic cube

As a way of promoting further mental and physical stimulation, a transparent cube measuring 512 cm^3 was constructed from 6 mm thick acrylic (Fig. 2). Two small 5 mm holes were drilled into five of the six sides to allow for scent detection of prey. A 15 mm wide hole was drilled centrally in the sixth side, which was fastened to the cube with transparent tape allowing easy keeper access to its contents. Neonatal mice or mealworms were periodically placed inside the cube atop the terrarium substrate for the monitor to retrieve with its forelimbs.

Results and Discussion

The common practice of feeding monitor lizards at the same location within the enclosure day after day can potentially produce two undesirable conditioned responses. First, it may lead to keeper-directed feeding aggression which can be potentially dangerous for keepers, especially when dealing with larger species. Alternatively, it can produce lethargic animals that sit and wait to be hand-fed rather than actively pursue and search for food in their enclosure as they normally would in the wild. In this study, feeding the black tree monitor at different locations within its enclosure and alternating usage of the drilled tree trunk as well as each individual tree hole has markedly reduced feeding aggression.

Fig. 2 The transparent, acrylic feeder cube.

Although no quantitative data were collected on the effectiveness of drilled tree trunks in increasing activity levels in black tree monitors, Mendyk and Horn (2011) noted that drilled tree trunks left within the enclosures of captives resulted in observable increases in activity levels and interest in the tree holes that still persisted weeks after experimental trials of the behavior had concluded. Observations of the black tree monitor interacting with the modified apparatus in this study corroborate these general findings (Fig. 3). As widely foraging predators, it is likely that arboreal monitor lizards routinely investigate holes and crevices in trees during daily foraging activities in the wild (Mendyk and Horn, 2011). Thus, facilitating the expression of this behavior in captivity may add a further natural element to their husbandry.

Fig. 3 The black tree monitor enjoying its enrichment option

The acrylic cube apparatus provides stimulation in several ways. Like the drilled tree trunk, retrieving prey from inside the cube requires insight, concentration, and skilled hand-eye motor coordination. The cube is also small and lightweight, which enables the monitor to manipulate and reposition it as it searches for a way to access the prey. This often involves pushing the cube around the floor of the enclosure (Fig. 4) or lifting and occasionally flipping it over on to a different side, providing further mental and tactile stimulation and requiring a new solution for solving the foraging task.

While the cube can very easily be constructed from other materials, the transparency of the acrylic has important advantages over non-transparent materials. Monitor lizards possess acute chemoreception (e.g., Auffenberg, 1981) and are excellent at locating buried or hidden prey through olfaction (e.g., Auffenberg, 1994; Blamires, 2004); however, sometimes when prey is detected through olfaction but cannot be seen or immediately accessed, a monitor will lose interest and abandon pursuit of the prey item (pers. obs.). By maintaining visibility of the prey item at all times, the monitor remains focused on the prey concealed within the apparatus and the task at hand. With six transparent sides but only one access point, this device complicates the foraging task that the monitor must solve in order to retrieve the prey. As would be expected, it took the black tree monitor in this study considerably longer to successfully extract prey from this apparatus than from the drilled tree holes, and in some cases the monitor wasn't able to retrieve the prey at all even after several days. Although only tested sparingly in this study, with experience, the time required to solve this foraging problem will likely decrease given the impressive learning abilities and memory capacities of monitors, especially when presented with food-driven tasks (Loop, 1976; Manrod et al., 2008; Gaalema, 2011).

Since this foraging tactic has also been noted in arboreal species closely related to *V. beccarii* (unpub. dat.), both enrichment devices described in this report should appeal to a range of species. Furthermore, due to the simplicity of these devices, both can easily and inexpensively be incorporated into existing captive management programs for these species.

Fig. 4 The feeder cube gets some heavy use, which includes the monitor pushing the cube around the exhibit.

Forelimb-assisted extractive foraging has yet to be observed in any monitors outside the *V. prasinus* species complex, although it is certainly possible that other taxa may possess similar abilities (Mendyk and Horn, 2011), to which kindred approaches to enrichment can be applied. For instance, instead of narrow holes drilled into tree trunks, terrestrial or rock-dwelling species could benefit from devices that are designed to resemble or function more like small animal burrows or rock crevices. Experimentation with various derivatives of this concept can lead to the development of taxon-appropriate forms of enrichment. Moreover, in addition to improving the lives of captives, offering novel enrichment stimuli could lead to the discovery of new and fascinating behaviors which can shed further light on the behavioral complexity, learning capacity, and intelligence of monitor lizards.

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