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Predation by Rufous Motmot on Black-and-Green Poison Dart Frog

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ABSTRACT.—I observed a Rufous Motmot (*Baryphthengus martii*) feeding a black-and-green poison dart frog (*Dendrobates auratus*) to another motmot in the Caribbean Slope lowland rainforest of northeastern Costa Rica. Neither individual appeared to suffer any ill effects from what was probably courtship feeding. Small vertebrates are typical prey for the larger species of motmots. Blue-crowned Motmots (*Momotus momota*) have been observed consuming several species of poison dart frogs raised in captivity but captive reared frogs either do not contain, or have reduced levels of, the toxins that native frogs produce. Relatively little is known about the effects of poison dart frog toxins on predators. Presumably, the digestive system of the Rufous Motmot is capable of neutralizing the potentially toxic effects of such prey. *Received 15 Sept. 1998, accepted 15 Feb. 1998.*

Poison dart frogs have long been known to possess toxic skin secretions, and, because of their bright coloration, are thought to be aposematic to visually hunting predators such as Rufous Motmots (*Baryphthengus martii*) which presumably have excellent color vision (Brodie and Tumbarello 1977). Smith (1975) demonstrated that hand-reared Torquoise-browed Motmots (*Eumomota superciliosa*) showed an innate avoidance of snake-shaped models with patterns simulating those of coral snakes. All other snake models were readily attacked implying that aposematic coloration is a deterrent to this species. Observations indicate that Blue-crowned Motmots (*Momotus momota*) at the National Aquarium consume several species of poison dart frogs including the black-and-green poison dart frog (*Dendrobates auratus*) and phantasmal poison dart frog (*Dendrobates tricolor*). However, these frogs were raised in captivity and either do not produce or have relatively low levels of the characteristic skin toxins (Kricher 1997; C. Rowsom, pers. comm.).

At approximately 9:30 CST on 26 March 1995, an adult Rufous Motmot was observed in secondary lowland tropical forest from a hiking trail located at Estacion Biologica La Suerte, near Cariari, Limon Province, northeastern Costa Rica (10° 26′ N, 83° 46′ W). The bird landed 25 m from the trail on an exposed perch 3 m above the ground and was easily observed for approximately 4 min. After 4 min another individual landed on the same branch next to the first individual. The newly arrived motmot was carrying a black-and-green poison dart frog in its beak which it fed immediately to the first individual. It is not possible to distinguish between sexes in Rufous Motmots; however, this behavior was interpreted as a male who was feeding the female as a courtship gesture. Both individuals had diagnostic black breast marks and raquet-tails indicative of adult birds, suggesting that this was probably not a fledgling being fed. The pair continued sitting on the branch for approximately 30 min after which they flew off together into the forest. Neither individual appeared to suffer any ill effects from either grasping or consuming the poison dart frog.

The typical diet of motmots varies somewhat in conjunction with body size. Smaller species prefer insects while larger species consume insects along with other invertebrates, small ver-

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tebrates, and fruit (Orejuela 1980, Remsen et al. 1993). The Rufous Motmot consumes arthropods, other invertebrates including crabs, small vertebrates including fish, lizards and birds, as well as fruit (Remsen et al. 1993). Frogs have been reported as a dietary component of the Rufous, Broad-billed (*Electron platyrhynchum*) and Torquoise-browed motmots (Remsen et al. 1993), and Blue-crowned Motmots in captivity (C. Rowsom, pers. comm.).

The effect of poison dart frog toxins on various potential predators has received relatively little attention. Brodie and Tumbarello (1977) tested the response of garter snakes (*Thamnophis sirtalis*) to *D. auratus* offered as prey. Snakes readily mouthed, or in some cases consumed the frogs but all exhibited head shaking, mouth opening, convulsions, and loss of equilibrium. Only one snake actually died and that was after consuming its third frog. These snakes do not possess color vision and might not be influenced by the aposematic coloration to the extent that an organism with color vision would be (Brodie and Tumbarello 1977).

While motmots in general may be warned by aposematic coloration, the Rufous Motmot at least is capable of handling and consuming this particular species of poison dart frog. *Dendrobates auratus* reaches densities of 1 individual/180 m^2 in one locality at La Suerte known to be frequented by Rufous Motmots (B. Graves, pers. comm.) One pair was observed on the ground rummaging through leaf litter where they would undoubtedly encounter *D. auratus* (B. Graves, pers. comm.). The level of toxins in the frogs of this area, how the motmots physiologically handle the toxins, and the frequency with which they consume *D. auratus* remain unknown.

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Evidence Of Egg Ejection In Mountain Bluebirds

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ABSTRACT.—When the last two eggs of Mountain Bluebird (*Sialia currucoides*) clutches were replaced with another bluebird egg and one House Sparrow (*Passer domesticus*) egg, 20% (3/15) of the sparrow eggs were removed within 24 hr. None of the surrogate bluebird eggs was removed. This is the first recorded instance of interspecific egg ejection in a bluebird species, and hole-nesters in general. *Received 2 Nov. 1998, accepted 18 Feb. 1999.*

Of the approximately 140 biological hosts of the Brown-headed Cowbird (*Molothrus ater*), fewer than 7% have been classified as rejectors (Friedmann and Kiff 1985, Ortega 1998). Rejectors typically remove cowbird eggs from the nest within 24 hr of introduction (Rothstein 1982). Ejection is accomplished either by grasping the cowbird egg between the mandibles or by puncturing the egg with the beak and then lifting the egg out of the nest (Sealy 1996). Acceptors, by contrast, do not remove cowbird eggs and in most cases provision the cowbird nestling(s) (see Petit 1991, Sealy 1996).

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