Two Potential Coral Snake Mimics in a Tropical Deciduous Forest

Smith (1975, 1977) has demonstrated a phenomenon which tropical field ecologists have long suspected (cf. Greene and Pyburn 1973), that a potential coral snake predator (in this case, the turquoise-browed motmot and great kiskadee) can be genetically programmed to avoid coral snakes. The existence of such programming, coupled with learning in some cases, could easily create an environment in which coral snake mimics evolve among animals other than snakes. I call brief attention here to two such animals from a forest in Santa Rosa National Park (SRNP), located about 35 km north of Liberia in Guanacaste Province, Costa Rica, which is also occupied by turquoise-browed motmots, great kiskadees, and many other carnivores that prey on small animals. The suggested model in this suggested mimicry is *Micrurus nigrocinctus*, a very ordinary-appearing coral snake (fig. 1).

FIGURE 1. *Micrurus nigrocinctus* (freshly killed) and a last instar larva of *Pseudosphinx tetrio* (live, 11 cm long).

FIGURE 2. Two- to four-year-old *Rhinoclemmys pulcherrima*, all animals from the vicinity of Park Headquarters, Santa Rosa National Park, Guanacaste Province, Costa Rica. Left, ventral view; center, dorsal view; right, dorsal view of more mature individual showing bright markings retained only on the dorsal surface of the gular scutes.

The first potential mimic is the larva of *Pseudosphinx tetrio* (Sphingidae) (fig. 1). This gaudy caterpillar feeds at night on the leaves of *Plumeria rubra* (Apocynaceae) and perches ostentatiously on one of the thick upper twigs (2-3 cm diameter) just below the leaves during the day. If approached or grasped, this larva violently waves its anterior portion back and forth, and is the only large moth caterpillar that I have encountered that viciously bites the hand that picks it up. This behavior is likewise conspicuous in *Micrurus* in SRNP and elsewhere in the Neotropics (Greene 1973, Greene and Pyburn 1973). The crown of *P. rubra* is very open, the leaves are large and widely spaced, and it is very easy to see these caterpillars from distances of

5-20 m. There is no way that they could be viewed as cryptic. The larvae are colored as in figure 1a from the first instar to the last, at which time they weigh as much as 15 g and are 15 cm long (1-3 cm diameter). *P. tetrio* caterpillars could be simply aposematic and fortuitously (or convergently) ringed in black, red, and yellow, they could be inedible Müllerian mimics, or they could be edible Batesian mimics. The former two possibilities are reasonable in the light of the generally toxic nature of plants in the family Apocynaceae. However, feeding on a toxic plant does not guarantee that a larva will be toxic if consumed.

The second potential mimic is the turtle *Rhinoclemmys pulcherrima.* This common terrestrial turtle is often encountered on the forest floor and along the margins of small forest streams, which it enters readily when traveling and foraging. The young turtles (0-2 year age range) are the most strikingly marked. As can be seen in figure 2, left, the ventral side of the carapace margin (ventral side of the marginal scutes) is brightly marked in alternating stripes or patches of intense red, yellow, and black. Dorsally, the young turtles have three concentric rings of black (center), yellow, black, red and black on each side of the carapace (approximately centered on each of the three large pleural scutes, fig. 2, center). There are three more, less perfectly circular, similar ocelli in the center of the back. At this age, the carapace is still moderately flexible, and any mammalian carnivore could easily chew up the turtle. When newborn, the turtle's carapace is only 3-4 cm long and flexible enough to be torn apart by even the two carnivorous birds mentioned earlier. As a *R. pulcherrima* ages, the dorsal color pattern becomes less bright, less even, and merges into the overall generally mottled color of the carapace (fig. 2, right). The dorsal color pattern of a turtle whose carapace is 10-15 cm in length (maximum size and presumably an adult) generally blends into the litter on the ground and in streams. The juveniles described above, however, are very conspicuous even when on forest-floor litter of dead leaves. Adults do not lose the bright colors on the ventral side of the carapace margin until they are very old and weathered, and on one part of the animal never lose the red-yellow-black coloration at all. On the dorsal side of the gular scutes, which is the surface directly below the head of a turtle with outstretched neck, the pattern remains vivid even in the oldest turtles. When looking straight down on the turtle from the front, this patch of color becomes abruptly visible when the head is withdrawn (fig. 2, right).

I hypothesize that the bright coral snake-like colors on the young *R. pulcherrima* will serve absolutely to deter some predators, and to slow predation attempts by others. If the potential predator has to take the time to inspect the young turtle to determine whether it is a coral snake or a harmless Batesian mimic, the turtle may gain a few extra seconds to dart down a crevice, into a brush tangle, or into water. When approached, the young turtles are often very active in running away from a person and into dense tangles of litter or standing vegetation. Older turtles, probably largely impervious to the potential mammalian predators found in this deciduous forest (coyotes, jaguars, ocelots, mountain lions, tayras, peccaries, coatis, etc.), may gain protection from a moment's pause by a predator that allows the retraction of limbs before they can be bitten off. I hypothesize that the pouncing predator will turn aside its strike upon perceiving that the moving object that caught its eye has red, yellow and black stripes associated. This hypothesis assumes that the large vertebrate predators either have color vision or are sufficiently discriminating to avoid animals with emphatically ring-marked bodies (the distinctiveness of a coral snake's markings lies in more than its colors). The margins of old *R. pulcherrima* carapaces in Santa Rosa National Park often have vertebrate tooth punctures and gouges in the scutes above and below the points of insertion of appendages. If *R. pulcherrima* is a coral snake mimic, it is a Batesian mimic since this turtle produces no offensive odors and does not bite hard or aggressively.

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