Tail displays of the false coral snake *Simophis rhinostoma* (Colubridae)

Otavio A.V. Marques

Laboratório de Herpetologia, Instituto Butantan, 05503-900, São Paulo, SP, Brasil

The similarities between certain colubrids and elapid snakes of the genus *Micrurus* are not limited to color pattern, but also include certain defensive behaviors (Greene, 1988; Pough, 1988; Marques and Puorto, 1991; Sazima and Abe, 1991). Experiments with plasticine models indicate that snakes with coral-snake pattern are subject to a lower frequency of predatory attacks than otherwise patterned snakes (Brodie, 1993). It seems likely that some colubrids with coral pattern that use defensive tactics similar to coral snakes of the genus *Micrurus* are also subject to low rates of predatory attacks (Greene, 1988; Pough, 1988; Marques and Puorto, 1991; Sazima and Abe, 1991).

Simophis rhinostoma is a South American colubrid snake belonging to the subfamily Colubrinae (Cadle, 1984). This terrestrial snake occurs in open areas and is sympatric with the elapids *Micrurus lemniscatus* and *M. frontalis* (Peters and Orejas-Miranda, 1970; Sazima and Abe, 1991; pers. obs.). *Simophis rhinostoma* displays several defensive behaviors which are similar to those displayed by *Micrurus*, such as erratic behavior and tail raising (Sazima and Abe, 1991). The color pattern is very similar to that of *M. frontalis* (see figures in Wickler, 1968; Campbell and Lamar, 1989; Sazima and Abe, 1991), although the rings are incomplete (i.e., do not reach the ventral region). Complete rings, however, are present on the tail, which is the area exposed to predatory attacks when the tail is coiled and raised in defensive behavior (Sazima and Abe, 1991). Some behaviors

such as tail vibrating and striking, common in *S. rhinostoma*, are absent in the defensive displays of *Micrurus* (Sazima and Abe, 1991; pers. obs.).

In September 1992, one specimen of *S. rhinostoma* kept in a laboratory was placed in a well-lit spot. Under this condition the specimen never exhibited tail vibration. When brought back to a dark place in the laboratory the specimen vibrated its tail. In order to assess the condition in which tail vibration occurs, 22 individuals of *S. rhinostoma* from southeastern Brazil were kept in terraria (52 × 27 × 20 cm), T = 20 to 25°C, with soil substrate and a thin layer of litter. Each specimen was mechanically stimulated by touching the body and the substrate for two minutes. Mechanical stimulus was provided in dark (< 5 lux) as well as in light (> 1000 lux) conditions. The behavior was recorded. The experiment was repeated three times for each individual at intervals of 24 h.

All individuals displayed tail raising behavior irrespective of light condition. The occurrence of tail vibration, however, differed between the two test conditions: eleven individuals vibrated their tails only in the dark, but when exposed to intense light they only displayed tail raising. The remaining individuals vibrated their tails in the light as well as in the dark. The fact that 50% of the tested individuals vibrated their tail only in the dark is significant ($X^2 = 5.5$, 1 df, $0.01 < P < 0.025$).

Tail vibration occurs among viperids (Azemiopinae and Crotalinae) and several species of colubrids, being regarded as a warning signal to predators (Greene, 1988, 1992; Sazima, 1988). This behavior is usually associated with the ability to retaliate (strike and bite) against a potential predator's attack (pers. obs.). In South America several genera of colubrine snakes (e.g. *Chironius*, *Dendrophidion*, *Drymarchon*, *Drymoluber*, *Mastigodryas*, *Pseustes* and *Spilotes*) display tail vibration behavior, and present the ability to retaliate against attacks, but tail raising is absent from their defensive repertoire (Greene, 1988; Martins and Oliveira, 1998; Marques and Sazima, in press; pers. obs.). The colubrine *S. rhinostoma* also retaliates attacks, and displays both tail vibration and tail raising (Sazima and Abe 1991, pers. obs.). Tail raising in *S. rhinostoma* may be regarded as mimetic convergence with *Micrurus* (Sazima and Abe, 1991) whereas tail vibration seems to be a plesiomorphic behavior in *S. rhinostoma*. However, more data on the phylogenetic relationships within the Colubrinae are needed to test this hypothesis.

Diurnal predators with keen sight may be the major selective agents responsible for the evolution of tail raising behavior of *S. rhinostoma*. Tail vibration, when performed by *S. rhinostoma* in well-lit environments probably decreases its chances of survival against certain predators, as this behavior renders the snakes less similar to the coral snake *Micrurus*, which does not vibrate its tail. This acoustic signal, however, may be advantageous in dark environments, since tail vibration and retaliation are associated within colubrine and viperid snakes.

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