(284)

ID451

Nuchal gland system: a novel defensive mechanism evolved in Asian natricine snakes

Akira Mori[1*], Teppei Jono[2], Hirohiko Takeuchi[1], Tatsuya Yoshida[1], Li Ding[3], Anslem de Silva[4], Tein-Shun Tsai[5], Tao Thien Nguyen[6], W. A. D Mahaulpatha[7], Indraneil Das[8], Guang-xiang Zhu[9], Yezhong Tang[3], Naoki Mori[1], Alan Savitzky[10], Gordon Burghardt[11]

1. Kyoto University, Japan
2. University of Ryukyus, Japan
3. Chengdu Institute of Biology, Chinese Academy of Sciences, China
4. Gampola
5. National Pingtung University of Science and Technology, Taiwan, China
6. Vietnam National Museum of Nature, Vietnam
7. University of Sri Jayawardenepura, Sri Lanka
8. University of Malaysia, Sarawak, Malaysia
9. Sichuan Agricultural University, China
10. Utah State University, USA
11. University of Tennessee, USA

*Presenting author's e-mail: gappa@ethol.zool.kyoto-u.ac.jp

Because of their carnivorous habit, snakes are often considered top predators in animal community. However, snakes are also exploited by many other predatory animals, and therefore, have evolved a variety of antipredator mechanisms. Nuchal glands are unique organs first described in a Japanese natricine snake, *Rhabdophis tigrinus* in 1935. Nuchal glands, which are ontogenetically mesodermal origin, consist of a series of paired organs embedded under the skin of the neck region. These glands contain bufadienolides, a group of cardiotonic steroids, which are sequestered from the skin toxins of toads consumed as prey. To use these toxic chemicals effectively to deter predation, *R. tigrinus* performs peculiar antipredator displays, such as neck arch and neck butting. Several other natricine species belonging to *Rhabdophis*, *Macropisthodon*, and *Balanophis* have similar organs, which are collectively called as nucho-dorsal glands. Some of these species have glands not only in the neck but also in the entire length of the body. We provide a brief overview of the history of the studies on the nuchal glands and related behavioral, ecological, and physiological features. We then present updated knowledge of the nuchal glands, especially concerning their morphological variation. Finally, we discuss the diversity of this unique defensive system, which involves correlated traits among morphological, ecological, behavioral, and physiological features.

Keyword: *Rhabdophis*, nuchal glands, antipredator mechanism, Asian natricines